SD11
A54
1988-89

ANNUAL LETTER

1988-89

INSTITUTE OF TROPICAL FORESTRY
RIO PIEDRAS, PUERTO RICO

SOUTHERN FOREST EXPERIMENT STATION

ANNUAL LETTER

1988-89

INSTITUTE OF TROPICAL FORESTRY
RIO PIEDRAS, PUERTO RICO

SOUTHERN FOREST EXPERIMENT STATION

LIBRARY COPY
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION

UNITED STATES
DEPARTMENT OF
AGRICULTURE

FOREST
SERVICE

SOUTHERN FOREST EXPERIMENT STATION
INSTITUTE OF TROPICAL FORESTRY
CALL BOX 25000
RIO PIEDRAS, P.R. 00928-2500
(809) 766-5335

Reply to: 4000

Date: July 24, 1990

Dear Friends:

This letter covers the period from October 1, 1988 and September 31, 1989, a time interval of great excitement and activity at the Institute of Tropical Forestry. Tables 1-3 at the end of the English version of the Annual Letter summarize the activities of the period. The main event, however, was the celebration of the Institute's golden anniversary.

The golden anniversary was a memorable occasion for all of us. Over two hundred people representing all tropical continents attended the event including the chief of the USDA Forest Service and Dr. Leslie Holdridge, the Institute's first scientist. Activities during the week-long anniversary celebration included a scientific symposium, field trips to the Luquillo Experimental Forest, a birthday cake celebration at the Institute headquarters, a picture exhibit depicting highlights of the Institute's fifty years, a poster exhibit, a special display at the Commonwealth archives of historic documents depicting forestry activities in Puerto Rico dating back to the 19th century, and the use of a special cancelation by the U.S. Post Office in conmemoration of the Institute's 50th anniversary. The U.S. Congress passed a resolution in recognition of the Institute's achievements.

Over the next year we will publish two documents that capture all the golden anniversary activities. One will be a book with all the papers presented at the Golden Anniversary symposium plus others written by Institute staff. The second publication will summarize the history of the Institute and some of the keynote speeches from the anniversary celebration.

I look forward to sharing with all of you these publications and other products of the Institute's research program. Please keep in touch with us regarding your own scientific activities in the field of tropical forestry.

Sincerely,

ARIEL E. LUGO
Director and Project Leader

LIBRARY COPY
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION

UNITED STATES
DEPARTMENT OF
AGRICULTURE

FOREST
SERVICE

SOUTHERN FOREST EXPERIMENT STATION
INSTITUTE OF TROPICAL FORESTRY
CALL BOX 25000
RIO PIEDRAS, P.R. 00928-2500
(809) 766-5335

Reply to: 4000

Date: 24 de julio de 1990

Estimados Amigos:

Esta carta cubre el período entre el 1 de octubre y el 31 de septiembre de 1989. Durante este año hubieron momentos de gran actividad en el Instituto. Las tablas 1-3 al final de la versión en inglés de la presente resumen nuestras actividades principales. Sin duda, el mayor evento fue la celebración de nuestro cincuenta aniversario.

La celebracion del aniversario de oro constituyó un evento memorable para todos nosotros. Estuvieron presentes más de doscientas personas, incluyendo representantes de todos los continentes con tierras tropicales, el jefe del Servicio Forestal de los Estados Unidos, y el Dr. Leslie Holdridge, primer científico del Instituto. Las actividades de esa semana incluyeron un simposio científico, excursiones al Bosque Experimental de Luquillo, una exhibición de fotos históricas de la institución, otra de afiches y una tercera de documentos históricos sobre la actividad forestal en Puerto Rico durante el siglo XIX. Una gran fiesta de cumpleaños con un bizcocho gigante se sumó a las actividades científicas y dio oportunidad para una mayor interacción personal y confraternidad entre los asistentes. El Servicio de Correos de los Estados Unidos adhirió a los festejos mediante el uso de un matasellos especial recordatorio del cincuenta aniversario. El Congreso de los Estados Unidos dictó una resolución reconociendo los logros del Instituto.

Durante el próximo año esperamos publicar dos libros que resumiran las actividades del aniversario. Uno será una obra técnica con los trabajos científicos presentados en el simposio y otros trabajos preparados por los científicos de nuestra casa. La segunda publicación será una síntesis de la historia del Instituto e incluirá algunos de los discursos de las personalidades que nos visitaron durante los actos de referencia.

Estoy ansioso de compartircon ustedes estas publicaciones y otros productos de la labor del Instituto. Manténganse en contacto con nosotros e informennos de sus labores forestales.

Cordialmente,

ARIEL E. LUGO
Director Project Leader

INSTITUTE OF TROPICAL FORESTRY ANNUAL LETTER
CARTA ANUAL DEL INSTITUTO DE DASONOMIA TROPICAL

TABLE OF CONTENTS/TABLA DE CONTENIDO

	Page/Página
Plantation Forestry Research	1
Investigación de Plantaciones Forestales	92
John K. Francis	
Cooperative Studies on Caribbean Pine Plantation Management	2
Estudios Cooperativos en el Manejo de Plantaciones de Pino Caribaea	93
Leon H. Liegel	
Tropical Silvics Manual	5
Manual de Silvicultura Tropical	94
John K. Francis	
Forestry Research and Management	7
Investigación y Manejo Forestal	96
Peter L. Weaver	
Ecological Studies	9
Estudios Ecológicos	98
Ariel E. Lugo	
Wildlife Research	15
Investigaciones de la Fauna Silvestre	100
Joseph M. Wunderle	
Other Wildlife Research	17
Otras Investigaciones de la Fauna Silvestre	102
Wayne J. Arendt	
Research on Wood Decomposition and Forest Entomology	22
Investigaciones en Descomposición de Madera y Entomología Forestal	105
Juan A. Torres	
Watershed Management	24
Manejo de Cuencas Hidrográficas	107
F.N. Scatena	
Special Studies	25
Estudios Especiales	108
Frank H. Wadsworth	
Tables 1-3/Tablas 1-3	27
Curriculum Vitae of the Institute and its Publications	41
Curriculum Vitae del Instituto y sus Publicaciones	110

PLANTATION FORESTRY RESEARCH

John K. Francis
Research Forester

Mahoe, *Hibiscus elatus*, is one of the best exotic timber species that has been introduced into Puerto Rico. Plantations of mahoe, 6 to 26 years old, across Puerto Rico were surveyed and evaluated (Francis and Weaver 1988). Originally from Cuba and Jamaica, mahoe can grow in most soils in areas where rainfall exceeds 1,500 mm per year. The species grows rapidly to a height of 20 to 30 m and reaches merchantable diameters of 0.4 to 0.6 m in 25 to 35 years. Basal areas of around 40 m^2/ha can be sustained and mean annual volume increments of 5 to 36 m^3/ha.yr will be accumulated in Puerto Rican plantations. Mahoe produces an attractive gunmetal gray wood of medium density that dries and machines well. Merchantable volume tables have been developed from 50 trees spanning diameters from 15 to 60 cm felled throughout Puerto Rico. Equations and tables for obtaining merchantable stemwood volume with and without bark, weight of merchantable bole as green wood and dried, and diameter of heartwood are presented in Francis (1989). A "local" equation for volume which requires only a knowledge of tree diameter (D) gives merchantable volume with bark (Vwb) in m^3:

$$Vwb = 0.1112 - 0.01312D + 0.0009599D^2$$

Hurricane Hugo severely affected the Luquillo Experimental Forest Arboretum containing 70 species, 0 to 30 years old. A few plots were completely destroyed; most suffered some limb breakage and wind throw. Only some of the recently planted plots escaped damage. The entire installation has been remeasured and the trees rated for damage. An additional visit 6 months after the hurricane will be made to determine delayed mortality of standing trees. By working with what is left and with new plantings, the area will be rehabilitated as time permits.

Literature Cited

Francis, J.K. 1989. Merchantable volume and weights of mahoe in Puerto Rican plantations. Research Note S0-355. Southern Forest Experiment Station, U.S. Departament of Agriculture, Forest Service, New Orleans, LA. 4 p.

Francis, J.K. and P.L. Weaver. 1988. Performance of *Hibiscus elatus* in Puerto Rico. Commonwealth Forestry Review 67(4):327-338.

Institute of Tropical Forestry. [n.d.]. Tropical silvics manual. SO-ITF-1 to 25. Southern Forest Experiment Station, U.S. Department of Agriculture, Forest Service.

U.S. Forest Service. 1990. Silvics of forest trees of the United States. Agricultural Handbook. U.S. Department of Agriculture, Washington, DC. (in press).

COOPERATIVE STUDIES ON CARIBBEAN PINE PLANTATION MANAGEMENT

Leon H. Liegel
Soil Scientist

There were two major accomplishments regarding finalization of the former US-AID Project: Growth and Site Relationships of Caribbean Pine on Diverse Soils in Costa Rica, Jamaica, Trinidad, and Venezuela (see 1986-87 and other previous Annual Letters). A re-edited manuscript was submitted for publication as an SO General Technical Report: Growth and Site Relationships of *Pinus caribaea* Across the Caribbean Basin. Five chapters, presented as case studies, summarize growth and yield and soils data collected from 1983-85.

Pre-publication results from the US-AID projects were presented via poster exhibits at two technical meetings: the Institute of Tropical Forestry Golden Anniversary Symposium, May 24-26, 1989 in San Juan, PR and the 1989 Society of American Foresters National Convention, September 24-27, in Spokane, WA. Site variability in the five countries is shown in Table 1. Stand conditions and growth and yield data are summarized, respectively, in Tables 2 and 3.

Tree form was poor in all countries. The least foxtailing was in Jamaica. Most plots had few cones per tree and little evidence of past or recent flowering. Considerable understory was present in all plots except on sands in Venezuela and on burned plots elsewhere. Greatest mean annual increment was in Costa Rica.

Table 1. Site diversity.

Country	Elevation (m)	Rainfall (mm)	Soils/Geology	1986 planting (ha)
Costa Rica	40-1,300	1,600-5,000	Silt, loams, and clays from volcanic and sedimentary rocks; recent ash deposits.	3,000
Jamaica	260-1,300	1,800-3,500	Shallow and deep clays from shales, volcanic rocks and red/yellow limestones.	8,100
Puerto Rico[1]	20-800	1,500-2,800	Sands over granite; shallow and deep clays over volcanic rocks and conglomerates.	500

Table 1. (cont'd).

Country	Elevation (m)	Rainfall (mm)	Soils/Geology	1986 planting (ha)
Trinidad	20-300	1,000-2,800	Sands and clays from igneous and calcareous rocks and sedimentary deposits.	5,400
Venezuela	<50	900-1,100	Sedimentary and aeolian sands.	200,000

[1] Though not a recipient of grant funds, Puerto Rico served as a comparison for growth data from other countries.

Table 2. Stand conditions.

Country	Plot No.	Plot Age	Forked (%)	Foxtail (%)	Prominent damage
Costa Rica	58	3-17	3-53	8-65	pathogens, fire
Jamaica	41	8-25	0-26	5-35	fire, wind
Puerto Rico	27	8-25	2-21	2-61	fire, human activities, wind
Trinidad	41	5-26	2-61	2-43	fire, human activities
Venezuela	44	4-15	13-43	6-53	ants, pathogens, fire

Table 3. Growth and yield.*

Country	Site index (m)	Total yield (m^3/ha)	Mean annual increment (m^3/ha.yr)
Costa Rica	26	550	35
Jamaica	24	400	27
Puerto Rico	25	485	32
Trinidad[1]	22	360	24
Venezuela[2]	21	475	32

* Outside bark volume yields for a rotation age of 15 years, an initial outplant density of 1,300 trees per hectare, and "best sites" only.

[1] Well-drained sites.

[2] Moist sites.

TROPICAL SILVICS MANUAL

John K. Francis
Research Forester

A project for the tropics paralleling the U.S. Silvics Manual was begun, several years ago and has progressed sufficiently to report in this Annual Letter. The project consist of short monographs on important tree species native to or planted in Puerto Rico. Monographs contain information on life history, growth characteristics, management methods, and uses. The information has been gleaned from the literature and from data collected by the individual authors. In most cases, distribution maps and photographs of the trees are included. They are published in English in 3-hole format to be assembled in binders as they appear. To date, entries for 28 species have been printed and about 30 more are being prepared. Silvical descriptions for another 20 tropical species will appear in the U.S. Silvics Manual when it comes out in the next year or so. Ultimately, we hope to combine all these descriptions into hard cover volumes with English and Spanish editions. Listed in the following table are species, authors, and publication numbers of the "Tropical Silvics Manual" entries published so far.

Species	Authors	Publication Number
Anthocephalus chinensis	A.E. Lugo and J. Figueroa	SO-ITF-SM-Ol
Rhizophora mangle	J.A. Jiménez	SO-ITF-SM-02
Laguncularia racemosa	J.A. Jiménez	SO-ITF-SM-03
Avicennia germinans	J.A. Jiménez and A.E. Lugo	SO-ITF-SM-04
Khaya senegalensis	A. Bokkestijn and J.K. Francis	SO-ITF-SM-05
Albizia procera	J.A. Parrotta	SO-ITF-SM-06
Albizia lebbek	J.A. Parrotta	SO-ITF-SM-07
Maesopsis eminii	J.K. Francis	SO-ITF-SM-08
Khaya nyasica	J.K. Francis and A. Bokkestijn	SO-ITF-SM-09
Agathis robusta	J.K. Francis	SO-ITF-SM-10
Araucaria heterophylla	J.K. Francis	SO-ITF-SM-11
Terminalia ivorensis	J.K. Francis	SO-ITF-SM-12
Hernandia sonora	J.K. Francis	SO-ITF-SM-13
Hibiscus elatus	P.L. Weaver and J.K. Francis	SO-ITF-SM-14
Enterolobium cyclocarpum	J.K. Francis	SO-ITF-SM-15
Eucalyptus deglupta	J.K. Francis	SO-ITF-SM-16
Guarea guidonia	P.L. Weaver	SO-ITF-SM-17
Bucida buceras	J.K. Francis	SO-ITF-SM-18
Pterocarpus macrocarpus	J.K. Francis	SO-ITF-SM-19
Andira inermis	P.L. Weaver	SO-ITF-SM-20
Thespesia grandiflora	J.K. Francis	SO-ITF-SM-21
Mammea americana	J.K. Francis	SO-ITF-SM-22

Species	Authors	Publication Number
Terminalia catappa	J.K. Francis	SO-ITF-SM-23
Dalbergia sissoo	J.A. Parrotta	SO-ITF-SM-24
Tabebuia donell-smithii	J.K. Francis	SO-ITF-SM-25
Syzygium jambos	J.K. Francis	SO-ITF-SM-26
Hymenaea courbaril	J.K. Francis	SO-ITF-SM-27
Fraxinus uhdei	J.K. Francis	SO-ITF-SM-28

FORESTRY RESEARCH AND MANAGEMENT

Peter L. Weaver
Research Forester

Natural Forests

Changes on seven permanent plots in the colorado forest of the Luquillo Mountains were observed for periods of 14 to 49 years after the 1932 hurricane, San Ciprián (Weaver 1989a). Changes include: (1) ingrowth and mortality rates of 20 stems per hectare per year, or a flux of 1.1% per year of the original number of stems; (2) greater diameters and heights indicating growth; (3) a decrease in the number of stems in the intermediate crown class and increase in the number of stems in the suppressed crown class, with gradual closing of the forest; (4) a 3.9% increase in the specific gravity of the dicotyledonous stems which reflects a decline of secondary species and the gradual dominance of climax species; (5) a decrease in the total number of species on all plots combined, with a tendency toward convergence of the number of species for all plots; (6) a gradual increase in the similarity of species compositions on individual plots; (7) a 35% decrease in the diameter increment of surviving trees; and (8) an annual increase in the mean aboveground biomass of 0.67 t/ha.yr.

Studies of arborescent vegetation in Puerto Rico's colorado forest in the Luquillo Mountains disclosed 15 tree species that were on the Island's threatened and endangered list (Weaver 1989b). Seven permanent plots established in 1946 provided a means to assess trends in the numbers of rare species and changes in population by species over time. Seventy-five temporary plots, varying in elevation, aspect and topography, provided information on spatial distributions of species along environmental gradients.

Plantations

Taungya plantings began during the 1930's in Puerto Rico when maria (*Calophyllum calaba*) and mahogany (*Swietenia macrophylla*) were established in the Luquillo Experimental Forest and the Commonwealth of Puerto Rico's Río Abajo Forest (Weaver 1989c). Farmers planted tree seedlings among subsistence crops such as corn, beans, bananas and plantains. Tree measurements conducted in the early 1980's provided estimates of mean annual volume increment (MAI) and current annual volume increment (CAI), both in cubic meters per hectare per year.

MAI's for mahogany in Luquillo and Río Abajo were 7.6 and 3.8, respectively, over the 45-year period of measurement. CAI's during the last two years were 12.1 and 7.8, respectively. MAI's for maria in Luquillo and Río Abajo were 4.8 and 3.2 over the 45-year measurement period. CAI's during the last two years were 5.0 and 9.4, respectively. Stand growth was satisfactory and representative of what could be expected on many sites in the tropics where plantings develop with a minimum of maintenance.

Plantation growth of mahogany (*Swietenia* spp.) and teak (*Tectona grandis*), and the performance of teak and Spanish cedar (*Cedrela* sp.) provenances located in subtropical dry and moist forest life zones, were studied on St. Croix, U.S. Virgin Islands (Weaver and Francis 1989). Hybrid mahogany (*S. macrophylla* x *S. mahagoni*) from St. Croix had the best form and growth rate of all tree species tested. The mean trunk volume growth of 30-year-old mahogany

hybrid was 8.1 m3/ha.yr, mean diameter growth was 0.78 cm/yr, and mean height growth was 0.47 m/yr. Comparable growth figures for 30-year-old teak were 3.9 m3/ha.yr, 0.76 cm/yr, and 0.5 m/yr, respectively. West Indies mahogany (*S. mahagoni*) after 25 years averaged 6.0 m3/ha.yr, 0.86 cm/yr, and 0.44 m/yr, respectively. Growth of the Pacific coast mahogany (*S. humilis*) and the Spanish cedar provenances was less satisfactory.

Forestry Planning and Management - Grenada

A technical report outlining Grenada's environment, forestry background, forest management plans, and recommendations for future forest activities was written during an FAO assignment to Grenada (Weaver 1989e). The ambitious forest management plans cover Grand Etang, Mt. St. Catherine, Levera, Carriacou, other forest reserve lands as well as the marginal lands on model farms and idle private lands. The major issues of management planning (water, wildlife, recreation, timber, research, use of forest lands, and policy and enforcement) were discussed.

Literature Cited

Weaver, P.L. 1988. *Guarea guidonia* (L.) Sleumer, American muskwood. SO-ITF-SM-17. Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 7 p.

Weaver, P.L. 1989a. Forest changes after hurricanes in Puerto Rico's Luquillo Mountains. Interciencia 14(4):181-192.

Weaver, P.L. 1989b. Rare trees in the Colorado Forest of Puerto Rico's Luquillo Mountains. Natural Areas Journal 9(3):169-173.

Weaver, P.L. 1989c. Taungya plantings in Puerto Rico. Journal of Forestry 87(3):37-41.

Weaver, P.L. 1989d. *Andira inermis* (W. Wright) H.B.K., Cabbage angelin. SO-ITF-SM-20. Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 7 p.

Weaver, P.L. 1989e. Forestry development Grenada - Technical Report: forestry planning and management activities. FO:TCP/GRN/8851. St. George's, Grenada. 112 p.

Weaver, P.L. and J.K. Francis. 1988. *Hibiscus elatus* Sw. mahoe. SO-ITF-SM-14. Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 7 p.

Weaver, P.L. and J.K. Francis. 1989. Growth of teak, mahogany and Spanish cedar on St. Croix, U.S. Virgin Islands. Turrialba 38(4):308-317.

ECOLOGICAL STUDIES

Ariel E. Lugo
Ecologist

Six questions on tropical species diversity that have eluded answers were evaluated in order to stimulate research during the Decade of the Topics Program of International Union of Biological Science Societies (Lugo 1988a). The questions are: (I) How is species diversity measured? (2) Why is there such a high diversity of tropical species? (3) How is high species diversity maintained? (4) What ecological function, if any, does high species diversity serve? (5) How do humans benefit from a high diversity of species? (6) How is the diversity of species changing today?

The discussion of the first question emphasizes the importance of quantitative and geographically referenced species inventories. Evolutionary and ecophysiological approaches to questions 2 and 3 should be clearly distinguished that attention is needed on the role of environmental factors, particularly stressors, and on the definition of terms such as "resources." The evolution of a high number of species and the maintenance of high species diversity are two different subjects that routinely get confused in the literature. I proposed a general model for the maintenance of high species diversity. In it, question 4 is addressed by relating the ecological function of high species diversity to the efficiency of resource use, particularly nutrients. Question five is addressed by noting that human interactions with, and dependency on, high species diversity has such a long history in the tropics that ecosystems formerly thought to be pristine are in fact human-derived. The resilient aspects of tropical forests vis-a-vis the current massive human intervention in the tropics, were highlighted under question 6. Protection of high species diversity will require improved management of tropical ecosystems, restoration and rehabilitation of damaged lands, sensible use of secondary forests and tree plantations, and greater attention to human needs.

Forest land rehabilitation was discussed in the 30th anniversary issue of the journal Environment (Lugo 1988b). The successional path of degraded forest lands can take a multiplicity of directions (Fig. 1). Sound forest management can help rehabilitate stands so they will become useful to people. Strategies for rehabilitating tropical forests are outlined in Box 1. Even in plantations of exotic trees, there are considerable numbers of native tree species which can be used to rehabilitate sites and ultimately approximate natural forest conditions (Fig. 2).

In another article (Lugo 1988c) I summarized literature suggesting ways to wisely manage forest lands in Latin America and high-

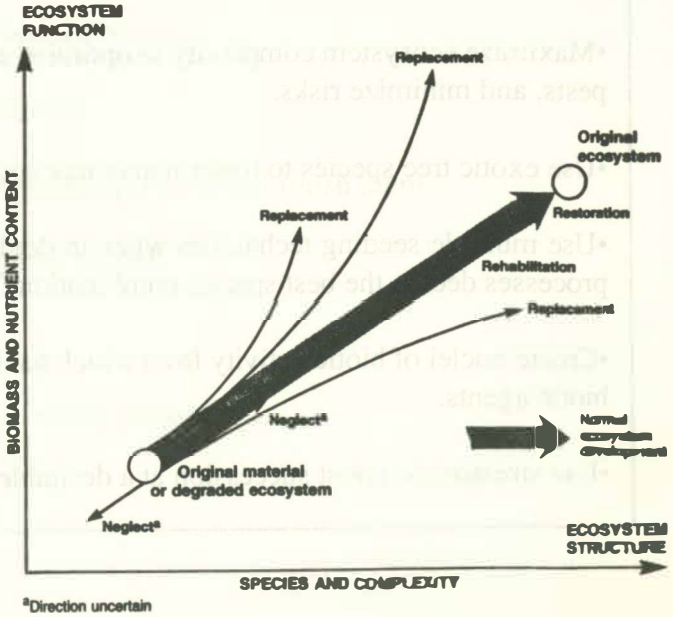

Figure 1. Alternative pathways for ecosystem repair.

Box 1. Strategies for rehabilitating tropical forests

•Maintain flexibility in the rehabilitation approach.

•Be alert to environmental conditions.

•Avoid specificity on the ultimate goals of rehabilitation.

•Maximize vegetation cover.

•Manipulate existing vegetation before attempting a substitution.

•Use fallow to do most of the forest rehabilitation.

•Restore tree cover as rapidly as possible.

•Be aware that nutrient-cycling strategies may change through a rehabilitation from phosphorus limitation to nitrogen limitation.

•Develop species mixtures based on their "ecological" combining ability.

•Keep topsoil moist, cool, and shaded.

•Couple ecosystems to maximize their value and accelerate rehabilitation (for example, use treated urban sewage as irrigation water to accelerate tree growth).

•Maximize ecosystem complexity to optimize use of site resources, maximize protection from pests, and minimize risks.

•Use exotic tree species to foster native tree species through site rehabilitation.

•Use multiple seeding techniques when in doubt as to what to plant, and let natural selection processes decide the best species combination for a site.

•Create nuclei of biotic activity from which habitat rehabilitation occurs under the influence of biotic agents.

•Use stressors to arrest succession at a desirable stage.

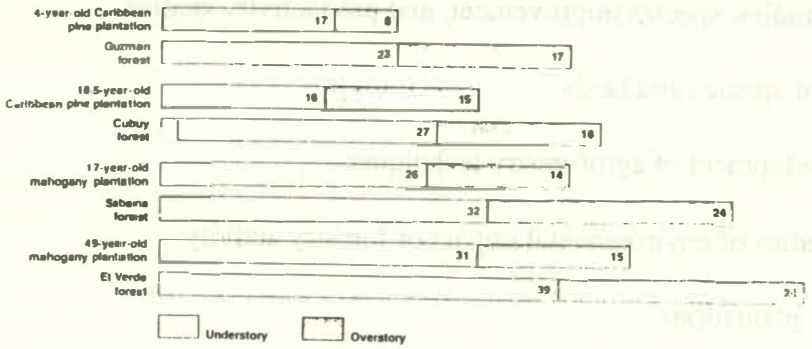

Figure 2. Number of species found in plantations and natural forests of similar age in the Luquillo Experimental Forest, Puerto Rico. Plot size was 100 square meters for understory and 0.25 hectares for trees. Exact age of natural forests is not known, but they are of similar age to the paired plantations. The plantation of Almendrón , or West Indies laurelcherry (*Prunus occidentalis*), followed the same patterns as others, although data are not available.

lighted research needs (Table 1). These management actions are needed to promote wise use of forest lands for energy and other products and services.

A book edited for the Agency of International Development by Winrock International (Lugo et al. 1987), provides detailed ecological guidelines for planning development projects.

Table 1. Suggestions from various authors to assure the wise use of forested lands in Latin America (Zobel 1987, Whitmore 1987).

1. Convince the habitants of each region of the importance of forested areas.
2. Plant species appropriate to the region and of known origin.
3. Know what is going to be done with what is planted.
4. Obtain the resources and the will to start management projects and finish them.
5. Plan realistic operations in order to avoid financial failure.
6. Long-term commitment.
7. Controlled government subsidies that cover the whole project.
8. Use lands adequate for forestry activity.
9. Start scientific research with emphasis on:
   - •restoration of degraded lands
   - •use of more species

•adaptability studies, species improvement, and productivity studies

•multiple use of species and lands

•industrial development of agroforestry techniques

•ecological studies of environmental impact of forestry activity

•use of energy plantations

•efficiency in the utilization of forest products

•multiple use of plantations

•techniques of economical optimizing of the forestry activity

•social, economic, and cultural aspects of forestry activity

•natural forest management techniques.

The majority of the book is dedicated to modules on protected areas for conservation, wood production, harvesting of forests, plantations, agroforestry, grazing systems, and acuaculture. These modules are presented in the context of sustainable development. Uses of tropical forest land are discussed in the context of life zones (Fig. 3).

I also published an analysis of conservation strategies needed in the tropics (Lugo 1989a). The analysis suggested nine elements for a tropical conservation ethic. These are: (1) centralize efforts on short and long term needs of people, (2) apply the highest ethical and humanistic standards possible, (3) use the best scientific information available, (4) integrate preservation ideas with those of wise use and ecosystem rehabilitation, (5) focus on public education, (6) trust that well-informed people will make the right decisions about resource conser-meeting of Caribbean foresters. Box 2 reprints

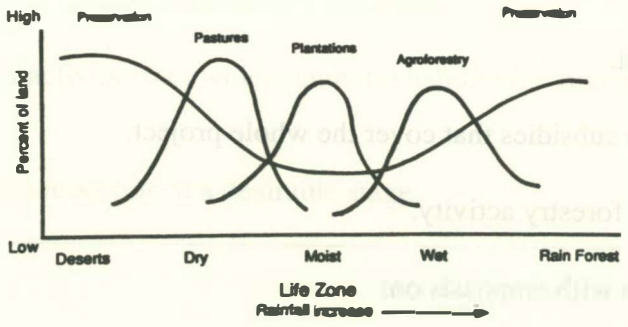

Figure 3. Examples of optimal land uses suggested by Holdridge (1967) life zones system.

Box 2

Editorial

The papers that follow describe the condition of wildlife and wildlife management in the Caribbean islands. Several items appear common to all islands, and they deserve special attention. The wildlife habitats of the Caribbean islands have been heavily modified by people, and this has had enormous impacts on wildlife. Because of this modification, the abundance of wildlife species has decreased considerably. This is best illustrated by the precipitous decline in the parrot populations of the islands, but many other wildlife species have declined as well. Accompanying the decline of native wildlife populations, exotic wildlife species appear to have increased considerably in terms of diversity and abundance. Some of these species, most notably the mongoose and monkeys, are out of control in many islands and are creating visible negative impacts on native wildlife species. As if these circumstances were not bad enough for Caribbean wildlife, it is obvious from the reports of the different islands that hunting of wildlife is poorly regulated in the region. The time and length of hunting seasons has little to do with the reproductive life cycle of hunted species. Bag limits are not necessarily related to wildlife population abundance nor restricted to certain sized individuals. Wildlife protection laws urgently require updating if this onerous situation is to be reversed. And law enforcement tools and activities require considerable improvement and expansion to give officials an opportunity to cope with the situation.

Illegal trade of wildlife to outside markets further contributes to the dismal conditions facing Caribbean island wildlife species. Foresters at the meeting urged island governments to sign the CITES convention because it provides powerful tools for controlling the illegal trade of wildlife. The wildlife situation in the Caribbean is clearly in crisis. It is ironic that at a time when the world is becoming painfully aware of the importance of tropical biological diversity, the islands that provided Europeans the first glimpse of exotic tropical animals (the parrots traded by Columbus during his first voyage), are now experiencing conditions that if not reversed will soon lead to the loss of a rich and diverse native wildlife. Speaking for all Caribbean foresters at the meeting, I make a call to all governments, interested citizens, and private organizations to make a concerted effort to improve the conditions under which Caribbean wildlife is managed. Let's act before it is too late for the islands!

Ariel E. Lugo
Institute of Tropical Forestry
Río Piedras, Puerto Rico
October 29, 1988

the editorial of the Caribbean foresters publication. It summarizes the plight of wildlife resources in the Caribbean.

Literature Cited

Lugo, A. 1988a. Diversity of tropical species: questions that elude answers. Biology International, Special issue 19, 37 p.

Lugo, A.E. 1988b. The future of the forest: ecosystem rehabilitation in the tropics. Environment 30(7):16-20 and 41-45.

Lugo, A.E. 1988c. Uso de las zonas boscosas de America Latina tropical. Interciencia 13(6):288-295.

Lugo, A.E. 1989a. Biosphere reserves in the tropics: an opportunity for integrating wise use and preservation of biotic resources. Pages 53-67 in W.P. Gregg, S.L. Krugman, and J.D. Wood (editors). Fourth World Wilderness Congress: Worldwide Conservation. Proceedings of the Symposium on Biosphere Reserves. USDI, National Park Service, Science Publications Office, Atlanta, Ga.

Lugo, A.E. 1989b. Forest lands in Puerto Rico and the Caribbean 500 years after their discovery by Cristoforo Colombo. Narrative, 80 slides, and appendix. 16 p.

Lugo, A.E., J.R. Clark, and R.D. Child (editors). 1988. Ecological development in the humid tropics: guidelines for planners. Winrock International, Institute for Agricultural Development, Morrilton, Arkansas. 362 p.

WILDLIFE RESEARCH

Joseph M. Wunderle, Jr.
Research Wildlife Biologist

During the past year, several different wildlife studies have been initiated and long-term project are on-going. Two of the studies are directly related to our efforts to help recover the endangered Puerto Rican Parrot, two projects focus on the effects of hurricanes on forest bird populations, and another project examines the habitat use and population biology of a North American migrant bird which overwinters in Puerto Rican forests. These continuing projects are summarized below.

Phenology Studies of Plants Which Produce Fruits and Seeds used by the Puerto Rican Parrot in The Palo Colorado Forest.

This study, based on three phenology trails with approximately 100 tagged trees and vines along each trail, is in its third year. The study has proven to be particularly useful in accessing the impact of Hurricane Hugo on the parrot's traditional food supplies. In addition, the study will permit us to examine the annual and year-to-year pattern of food availability in an effort to better understand parrot habitat use.

The Effect of Rearing Conditions on the Development of Food Handling Abilities of Hispaniolan Parrots

An aviary study on the development of parrot feeding behavior has been initiated in collaboration with Dr. Marcia Wilson (US Fish and Wildlife Service) in an effort to determine the optimal age for release of captive-reared parrots. Young parrots do not initially have the feeding skills of adults, and only after much experience do they obtain adult abilities. The inept foraging skills of juvenile birds are known to contribute to increased mortality in a diversity of bird species, and are likely to be important to parrots. Thus it will be valuable to release captive-reared parrots at an age when they have achieved the foraging proficiency of adults. The aviary study is not yet completed, but a major review article on juvenile foraging proficiency in birds has been completed.

The Effect of Hurricanes on Terrestrial Bird Populations

Hurricanes are one of the most important disturbance factors in many tropical forests. Studies of the impact of hurricanes on forest wildlife will help us to identify species which are at greatest risk as well as aid us in designing management strategies for threatened and endangered species. In collaboration with Dr. Robert B. Waide and Dr. D. Jean Lodge (Center for Energy and Environment Research) I studied the effect of Hurricane Gilbert on the avifauna of Jamaica. Hurricane Gilbert struck Jamaica on 12-13 Sept. 1988 with sustained winds of 126 mph which swept through our 10 sites established before the storm in Dec. 1987. We returned to these 10 sites four months after the storm and replicated our baseline methods (mist netting, fixed-radius point counts, and vegetation measurements). Three montane sites (cloud forest, pine, and coffee) showed significant declines in total number of individuals and species while two lowland sites (wet limestone forest and mangroves) showed significant increases; the remaining lowland sites showed no change. The species which showed the greatest declines in montane regions were those which were most dependent upon plants for food (nectarivores, frugivores or seed-eaters), while

insectivores rarely declined. Thus the storm's short-term impact on terrestrial birds was complex, often depending upon elevation, habitat type, and sometimes guild.

Habitat Use and Population Biology of the Black-throated Blue Warbler Overwintering in Puerto Rico

In recent years, biologists have shown considerable concern regarding the fate of North American migrants which overwinter in the tropics. Much of this concern arises from the massive habitat destruction on the migrant's wintering grounds. In light of this concern, I have initiated a research project on the Black-throated Blue Warbler, an indicator species for the Luquillo Experimental Forest. So far, this study has documented sexual habitat segregation and uncovered differences in habitat use in different forest types. The study involves banded individuals and will provide information on survivorship in different habitats and help us identify critical wintering habitat for this species.

OTHER WILDLIFE RESEARCH

Wayne J. Arendt
Wildlife Biologist

Pearly-eyed Thrasher Monograph

Research into the ecology and life-history traits of the Pearly-eyed Thrasher continues. Following Diamond's (1974) supertramp concept, analyses of 210 species of Caribbean landbirds (Columbiformes through Passeriformes, excluding Falconiformes) show that *Margaropsfuscatus*, one of 3 supertramp species found in the Caribbean (Table 1), is the region's premiere example of a true avian supertramp. Supertramp species are exceptional colonizers, but very poor competitors within species-rich avian communities. They are generally r-selected species that have evolved a high reproductive potential featuring rapid and extended breeding and large (or) multiple clutches each season. Moreover, superior colonizers typically have the ability to make marked shifts in altitudinal range, habitat type, diet, and foraging techniques. This ability permits successful establishment and growth of colonizing populations that have reached an island and high population densities in established populations.

Table 1. Distribution of West Indian birds following Diamond's (1974) High-S and tramp species categories and degree of Endemism. High-S species are generally k-selected, endemic species within species-rich communities and often confined to a single large island and one habitat type. Tramp species (A-D) are those species generally found on smaller as well as large islands and within more species-poor communities as well as more diverse communities, with A-tramps being the most similar to High-S species and D-Tramps most similar to Supertramps. Whereas A- and B-tramps are confined to the larger islands within a smaller geographical area similar to High-S species, C- and D-tramps are found throughout the Caribbean on most islands, small and large, and in many habitat types. However, Supertramps, although being found throughout the region, are confined to small, species-poor islands or species-poor communities on at least one fairly large island (Puerto Rico).

Category	No. Species	No. Islands	Degree of Endemism		
			None	Subspecies	Species
High-S	118	1- 6	0	37	81
A-Tramp	17	2- 11	0	15	2
B-Tramp	11	7- 14	0	9	2
C-Tramp	25	12- 44	0	23	2
D-Tramp	15	35-148	3	12	0
Supertramp	3	10- 82	0	3	0

Of some 177 West Indian islands from which the total number of breeding land-bird species could be determined, the Pearly-eye was shown to be a permanent (breeding) resident on 82 islands, all of which are small, species-poor islands or species-poor habitats on larger islands (e.g., Puerto Rico; Fig. 1).

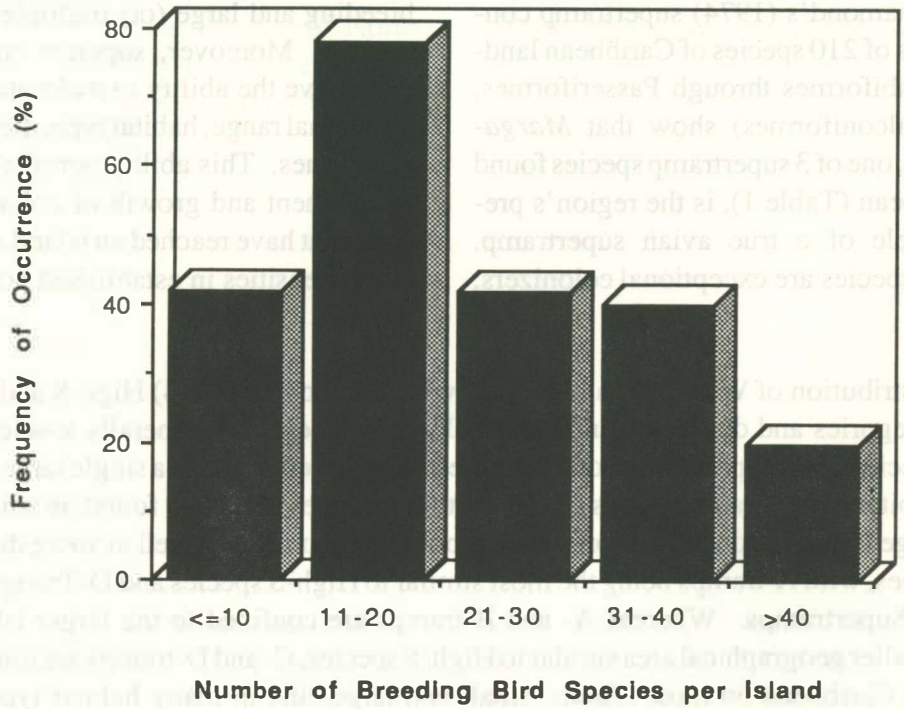

Figure 1. Distribution of the Pearly-eyed Thrasher on 177 islands within the Greater Caribbean Basin.

Investigations into the ecology of the Pearly-eye over the past 11 years have shown that it (a) is an excellent disperser with superior homing abilities; (b) is a habitat generalist, inhabiting such areas as strand vegetation on the coast, urban environments, dry, and wet forest habitats on the highest mountain peaks; (c) is an omnivore; (d) shows varied spaciotemporal foraging zones and techniques; (e) obtains high population densities; (f) shows subtle sexual dimorphism; and (g) shows intra- and inter-island morphological variation among allopatric populations.

Long-term Monitoring of Guánica Birds

Longevity

Tropical birds were thought to outstrip their northern counterparts in terms of increased adult survival. For North American migrant passerines, although a few longevity records of 5-10 years exist, the average individual lives but 1-3 years (Klimkiewicz *et al.* 1983, Klimkiewicz and Futcher 1987).

Seventeen-year survival data taken on resident birds at our traditional net-line in the Guánica Forest in southwestern Puerto Rico show that at least some of the individuals of the resident birds inhabiting the Guánica Forest are long-lived. Faaborg and Arendt (1989a) published a summary of longevity records for 21 species of Guánica forest birds (Table 2). Individuals in 12 of the 21 species were shown to

survive more than 5 years, with some individuals surviving 11 and even 14 years. These longevity estimates become even more impressive considering that 67% of the sample sizes contained 50 or fewer individuals and the average return rate for the 21 species was only 20%, with even lower return rates in 13 species.

Table 2. Banding and longevity information for bird species banded and recaptured in the Guánica Forest, Puerto Rico.

Species	Number Banded	Number Recaptured	Estimated Longevity (Years-months)
Common Ground-Dove	50	3	2-07
Mangrove Cuckoo	9	1	2-07
Puerto Rican Lizard Cuckoo	8	2	3-07
Puerto Rican Tody	40	7	14-06
Puerto Rican Woodpecker	11	2	4-07
Caribbean Elaenia	60	6	5-07
Puerto Rican Flycatcher	56	16	11-07
Red-legged Thrush	50	14	7-07
Pearly-eyed Thrasher	101	18	11-07
Puerto Rican Vireo	19	7	9-04
Northern Parula	36	2	7-07
Adelaide's Warbler	68	10	7-06
Black-and-white Wabler	47	13	4-07
American Redstart	62	11	7-06
Prothonotary Warbler	3	1	4-07
Ovenbird	24	4	2-07
Bananaquit	291	38	6-07
Stripe-headed Tanager	24	4	6-07
Puerto Rican Bullfinch	228	46	7-07
Blackcowled Oriole	2	1	2-06
Troupial	15	2	4-06

More recently (January 1990), a 17-year-old Puerto Rican Flycatcher (*Myiarchus antillarum*) was recaptured during banding operations. With this recapture, the previous longevity record for the species was surpassed by 6 years, while the longevity record for all North American flycatchers (13 years, 11 months for a Great Crested Flycatcher) was surpassed by almost 4 years. This is a conservative estimate since this individual was recorded as an adult at its first capture. During the same sampling period, a ten-year-old Puerto Rican Bullfinch

(*Loxigilla portoricensis*) was captured. With this recapture, the previous longevity record for the species was surpassed by about 3 years. This longevity estimate is more precise because the individual was recorded as a juvenile (1-2 years old) at first banding.

Population Declines

Within the past two decades, some two dozen articles have documented population declines in North American migratory birds (Aldrich and Robbins 1970, Holmes and Sherry 1986). Results for North American migrant warblers from our Guánica net-line (Faaborg and Arendt 1989b) show a steady decline in the number of individuals of migratory (seasonal) residents throughout the study period.

Morphometrics of Guánica Birds

The banding study at Guánica now encompasses more than 2,000 total captures of 40 species of birds in 14 avian families (Arendt and Faaborg 1989). We have body mass and wing length measurements of 246 individuals of 25 species of birds that were captured and recaptured 612 times. these data were used to show that: (l) among and within different individuals, temporal variation is minimal when measurements are taken at the same time of the year; (2) measuring instruments widely used in the field are precise; (3) sampling techniques are comparable; (4) investigator influence (bias), for single and cooperative banders, is minimal even when small samples are compared. Seasonal and daily variation within the data did appear, however, and were attributed to seasonal fluctuations of food resources, feather wear, breeding activities, and the added mass of ingested food.

These data emphasize that the time of measurement is a critical factor when comparing morphological measures among different studies. Comparing measures from one season with those from another, or comparing measures taken during a whole year with those taken during a brief period, may show differences that are not biologically significant.

Wildlife Assessments in the Caribbean

To compliment earlier investigations into the breeding biology and habitat use of the Cattle Egret in Montserrat, West Indies (Arendt and Arendt 1988), I documented the range expansion of *Bubulcus ibis* in the Greater Caribbean Basin (Arendt 1988).

The Cattle Egret was first reported in the Caribbean from Old Providence Island in 1933. It was not reported again from the region until 1944, when an individual was sighted in Aruba, Southern Netherlands Antilles. Within 4 years, the species was reported in Puerto Rico and Jamaica more than 800 km north of Aruba in the Greater Antilles. By 1957, Cattle Egrets were successfully nesting in nearby Cuba and St. Croix. Today, the species is known from more than 50 major islands throughout the Caribbean Basin.

Cattle Egrets show strong dispersal tendencies and migratory behavior. The first Cattle Egrets to reach the Caribbean islands were probably migratory individuals. Rapid range expansion in the Caribbean and throughout the neotropics was concomitant with increased animal husbandry and intense agricultural practices, including irrigation and burning regimes. The success of the Cattle Egret in the Caribbean region is also attributed to its high reproductive rate, exponential population growth, extended breeding seasons, and few vertebrate predators, owing to the region's insularity.

Literature Cited

Aldrich, J.W. and C.S. Robbins. 1970. Changing abundance of migratory birds in North America. Smithsonian Contributions in Zoology 26:17-26.

Arendt, W.J. 1988. Range expansion of the Cattle Egret (*Bubulcus ibis*) in the Greater Caribbean Basin. Colonial Waterbirds 11(2):252-262.

Arendt, W.J. and A.I. Arendt. 1988. Aspects of the breeding biology of the Cattle Egret (*Bubulcus ibis*) in Montserrat, West Indies, and its impact on nest vegetation. Colonial Waterbirds 11(1):72-84.

Arendt, W.J. and J. Faaborg. 1989. Sources of variation in measurements of birds in a Puerto Rican dry forest. Journal of Field Ornithology 60(1):1-11.

Diamond, J.M. 1974. Colonization of exploded volcanic islands by birds: the supertramp strategy. Science 184:803-806.

Faaborg, J. and W.J. Arendt. 1989a. Longevity estimates of Puerto Rican Birds. North American Bird Bander 14:11- 13.

Faaborg, J. and W.J. Arendt. 1989b. Long-term declines in winter resident warblers in a Puerto Rican dry forest. American Birds 43(4):1226-1230.

Holmes, R.W. and T.W. Sherry. 1986. Bird community dynamics in a temperate deciduous forest: long-term trends at Hubbard Brook. Ecological Monographs 56:201-220.

Klimkiewicz, M.K., R.B. Clapp, and A.G. Futcher. 1983. Longevity records of North American birds: Remizidae through Parulinae. Journal of Field Ornithology 54:287-294.

Klimkiewicz, M.K. and A.G. Futcher. 1987. Longevity records of North American birds: Coerebinae through . Journal of Field Ornithology 58:318-333.

RESEARCH ON WOOD DECOMPOSITION AND FOREST ENTOMOLOGY

Juan A. Torres
Wildlife Biologist

Research was conducted on the invertebrates that participate in the decomposition of Palo Colorado (*Cyrilla racemiflora*), Guaba (*Inga vera*) and Motillo (*Sloanea berteriana*) wood. In Palo Colorado, I found that the most important decomposers were larvae of the Cerambycidae (Coleoptera). Termites have a minor role in Palo Colorado wood decomposition on the wet to rain Luquillo Experimental Forest. However, transplant experiments of Palo Colorado logs to the Guánica Forest demonstrated that termites are very important in wood decomposition in dry tropical forests. The cerambycid larvae are responsible for the formation of cavities in Palo Colorado. They can penetrate Palo Colorado wood easily and facilitate the penetration of fungi that help in the creation of cavities. The decomposition of Guaba and Motillo logs appears to occur faster than in Palo Colorado logs in the Luquillo forest. Guaba and Motillo are easily attacked by bark beetles (Scolytidae) pin hole beetles (Platypodidae), termites, cerambycids, and dipteran larvae. The entrance of dipteran larvae to the wood interior is facilitated mainly by the activities of the cerambycids.

The invertebrate community that participates in wood decomposition has been observed in all the decay classes in Palo Colorado. This information is being collected for Guaba and Motillo. Also, the distribution of nutrients in all the decay classes in Palo Colorado and in the different radial sections is being analyzed. Palo Colorado trees have a propensity to extract nutrients from its own dead parts via adventitious roots. Also, it can send above ground roots in any direction to bromeliads or to other Palo Colorado trees.

This year I started collaborative research with Dr. Thomas Atkinson from the University of Florida to study the systematics of Scolytidae and Platypodidae in Puerto Rico. Emphasis is on insect-host tree relationships and the members of these insect families that attack vines and seeds. The seeds of Tamarindo (*Tamarindus indica*), María (*Calophyllum brasiliense*), Pomarrosa (*Eugenia jambos*), Palma de Sierra (*Prestoea montana*), and Jácana (*Pouteria multiflora*) can suffer heavy damage due to the actions of these Insects.

I published a paper on the effects of hurricanes on insect migrations (Torres 1988) and another on fungus grower ants (Torres 1989). One of these ant species is very important in the dispersal of seeds in the dry Guánica forest. In addition, a paper dealing with the ecological, toxicological, and agricultural effects of the introduced fire ant (*Solenopsis invicta*) will appear soon in the Journal of Agriculture of the University of Puerto Rico.

I am summarizing data from over 200 papers on insect activity at the Luquillo Experimental Forest. In collaboration with Roy Snelling from Los Angeles Museum of Natural History I am conducting a work on the systematics of Puerto Rican ants. About 13 new species are described. Also, in collaboration with Daniel Simberloff from Florida State University I am preparing a paper on the biogeography of ants in the islands that border Puerto Rico.

Literature Cited

Torres, J.A. 1988. Tropical cyclones effects on insect colonization and abundance in Puerto Rico. Acta Científica 2:40-44.

Torres, J.A. 1989. The status of the fungi-grower ants (Hymenoptera: Formicidae) in Puerto Rico and adjacent islands. Journal of Agriculture, University of Puerto Rico 73(4):401-403.

Torres, J.A. Efectos ecológicos, toxicológicos y agrícolas de la hormiga Brasileña, *Solenopsis invicta*. Journal of Agriculture, University of Puerto Rico (in press).

WATERSHED MANAGEMENT

F.N. Scatena
Hydrologist

The 1989 fiscal year was a both a busy and productive year for watershed research at the Institute. Major activities included environmental monitoring and biomass harvests.

Since European settlement, about 490 years ago, the watershed area has been explored for precious ores, cultivated and selectively logged (Scatena 1989). The most rapid transformation of the landscape occurred at the end of the 19th century and the beginning of the 2Oth century. During this period the watersheds remained forested but were cultivated for coffee, logged, and impacted by three major hurricanes. On September 17th and 18th, 1989 Hurricane Hugo passed over the eastern portion of the Puerto Rico and severely impacted the watersheds for the fourth time in the pass 100 years.

The Institute has an active volunteer and collaborative research program in the watersheds. Students and researchers from Asia to Alaska visited and worked within the Bisley watersheds. One of most ambious and integrated research projects of the year was the biomass harvesting and soil studies done in cooperation with Yale University and the University of Pennsylvania. Two, 32 x 32 meter plots in the Bisley area were map·and sampled for vegetation, soils, root biomass, and fauna populations in the months prior to June 1989. In June both plots were cleared of vegetation with the assistance of the Caribbean National Forest personnel. Selected trees were sampled for biomass, and series of detailed studies on changes in soil nutrient pools and below ground biomass were begun.

Literature Cited

Scatena F.N. 1989. An introdùction the the physiography and history of the Bisley Experimental Watersheds in the Luquillo Mountains of Puerto Rico. General Technical Report S0-72. USDA Forest Service Southern Forest Experiment Station. 22 p.

SPECIAL STUDIES

Frank H. Wadsworth
Research Forester

The work emphasizes the transfer of technology derived from studies at the Institute and elsewhere in the tropics. The first concern has been manuscript completion for the technical book "Forest Production for Tropical America," a project now in progress for many years. Remaining details concern development of tabular material, illustrations, a glossary, and key-word indexing of a large bibliography. Late in the year a constructive session was held in New Orleans with editor Susan Branham.

I continue to edit the ISTF News, a quarterly bilingual newsletter of the International Society of Tropical Foresters, cosponsored by the Society of American Foresters. It involves reviewing and extracting selected contents of more than a hundred pertinent journals and other organs and publications and reports received by the Institute's library. In total 56 printed pages of text were produced in both English and Spanish, including 114 distinct articles or extracts and announcements and brief descriptions of 78 major current publications on tropical forestry. In a membership survey that brought 633 responses (37 percent) nine out of ten readers rated the publication as good to excellent.

In behalf of ISTF I visisted Brazil, Paraguay, Argentina, Bolivia, Venezuela, Costa Rica, Honduras, and Guatemala to determine the communications needs and potential in the region for more effective interaction among foresters. Over 750 people were contacted. The made more than 25 constructive suggestions on. Also presented were ideas for further investigating the productive potential of immature trees in secondary tropical forests. This subject proved popular and provoked good audience response.

While advising the Eastern Caribbean Natural Areas Management Program I developed a secondary forest silvicultural treatment plan for the mountain forests of Dominica. I also submitted recommendations for the development of Sage Mountain National Park in the British Virgin Islands, and obtained funds to begin an inventory of endangered plants in the Lesser Antilles.

As a member of a multi-national group of technical advisors I helped prepare recommendations to the forest management committee of the International Tropical Timber Organization. These recommendations were adopted as a basis for the present program of ITTO. I served also as U.S. member of a 10-person ITTO team reviewing the sustainability of forestry practices in Sarawak, Malaysia. The forest of three trips to the country, completed during the year, covered timber production, processing, and trade. Additional information is to be gathered to clarify sustainability.

I developed with Mexican representatives of the Silvicultural Study Group of the North American Forestry Commission a proposal, plan, and program for an international workshop on tropical forestry research technology to be held in tropical Mexico late in 1990.

I also provided technical counsel at meetings of national scope concerned with tropical deforestation and potential U. S. leverage through restraint of trade in tropical timber. One of these meetings was sponsored by the Rainforest Alliance and another by the International Hardwood Products Association and the Smithsonian Institution. Both meetings brought to light the

dangers of tropical timber embargoes and identified alternative methods to create incentives for better forest practices.

An assignment of one day per week to support technically the Chief of the Puerto Rico Forest Service has led to a variety of tasks, the most important of which is leadership in the preparation of improved management plans for each of the 14 State Forests. Forest managers from each of the forests have contributed ideas concerning policies, strategies, and procedures. The accumulation of background information for each forest has begun. Another task with the Service concerns urban tree replacement following hurricane Hugo. It involves the coordination of public and private tree nurseries, tree species selection, and promotion of planting. A paper on the history of forest plantating on the Guánica State Forest was presented during a public symposium at the University of Puerto Rico.

Technical consultation was provided to the Caribbean National Forest through reviews of draft amendments to the land and resource management plan, participation on the promotional team for the proposed Portal del Yunque visitor center, the Puerto Rican parrot Advisory Group, and leadership of a CNF team to develop a demonstration plan for diverse practices in the National Forest. A paper on the 50-year history of research participation in National Forest management was presented at the Institute's 50th Anniversary celebration.

For the 37th consecutive year the Nature Team, a group of 16-18-year-old young men who lead advancement training at the Guajataka Scout Reservation, was trained during four spring weekends in diverse aspects of resource awareness, appreciation, and conservation . Among other things, they applied inventories and refinement treatment to mahogany plantations and native forest plots within the Reservation. From this Team have come several professionals in forestry and allied resource careers.

Table 1. Activities Institute staff participated in during FY 1988-89.

Commonwealth of Puerto Rico	National	International
-Numerous radio and television interviews and programs.	-Addressed the Society of American Foresters at their annual meeting in Rochester, N.Y.	-Addressed an International meeting on deforestation, Oaxaca, Mexico.
-Addressed the Island Ecology Symposium, InterAmerican University, San Juan.	-Various meetings of the United States Man and the Biosphere Program.	-Speaker at a symposium on development in the Dominican Republic.
-Expert witness in Federal District Court.	-Hosted numerous visitors including:	-Studied the impact of a hurricane on bird populations in Jamaica.
-Reviewed the research program at the Center for Energy and Environment Research, University of Puerto Rico.	•Writters for National Maganizes, •Deans of Southern Forestry Schools and a dozen distinguished scientists, •Beta Beta Beta National Convention at the Luquillo Experimental Forest, •United States Congressmen, •Scientists from the Woods Hole Marine Laboratory, •Professors from the Yale School of Forestry, •Two staff members from OMB, Washington, D.C. interested in global change phenomena, •Representatives of the National Science Foundation, Long Term Ecological Research,	-Moderator, Avian Conservation Session of the Caribbean Ornithological Society Symposium, Dominican Republic.
-Advised Department of Natural Resources biologist on management of Boquerón State Forest.		-Lectured on ecology and life-history traits of a bird species at the Caribbean Ornithological Society Symposium, Dominican Republic.
-Judged the Science Congress for High School students.		-Consultancy for the FAO in Grenada.
-Inspected mangroves under litigation by the Corps of Engineers at Culebra, P.R.		-Consultancy for the World Bank in Brazil.
-Advised the Olympic Committee on the reforestation of the Olympic village.		-Participated in Annual Meeting of Eastern Caribbean Natural Areas Management Program.

Table 1. (cont'd).

Commonwealth of Puerto Rico	National	International
-Advised both parties in litigation over illegal uses of mangrove forests at Las Picuas.	•Representatives of American Forestry Association.	-Technology transfer to Cottage Forest Industries of Dominica, W.I.
-Planned and executed an exhibit, where a rain forest was reconstructed for over 20,000 visitors at Plaza Las Americas.	-Program for National Public Radio.	-Participated in annual meeting of Silviculture Study Group of the North American Forestry Commission.
-Lectured to the Department of Natural Resources on tropical forests and the global carbon problem.	-Lectured on rain forests to the Philadelphia Museum of Natural History.	-Forestry presentations in Brazil, Paraguay, Argentina, Bolivia, Venezuela, Costa Rica, Honduras, and Guatemala for International Society of Tropical Foresters.
-Open House at El Yunque.	-Reviewed the Organismic Biology Program of Harvard University.	-Reviewed with visitor from the FAO recent research results.
-Presentation of papers at the Institute's Golden Anniversary Symposium.	-Presented Caribbean National Forest Land Management Plan to the Chief.	-Hosted scientist from Sweden and showed recent research on the Luquillo Experimental Forest.
-Celebration of the Institute of Tropical Forestry Golden Anniversary.	-Visited Station Headquarters in New Orleans.	-Technical assistance trip to Sage Mountain Park, Tortola, B.V.I.
-Conducted field trips for the Institute's Golden Anniversary.	-Contributed to a panel evaluation of scientists.	-Participated in tropical forestry meeting of International Hardwood Producers Association in Washington, D.C.
-Meeting of the Puerto Rican Parrot Working Group.	-Reviewed Yale's School of Forestry program.	
	-Participated in a nutrient cycling workshop.	

Table 1. (cont'd).

Commonwealth of Puerto Rico	National	International
-Testified at the Puerto Rico Senate on a bill to modify the Puerto Rico Forest Law.	-Participated in the Cary Arboretum Conference on Comparative Ecology.	-Participated in ITTO Mission in Sarawak, Malaysia.
-Sponsored and supervised undergraduate research at Colegio Universitario de Cayey.	-Project Leaders meeting.	
-Field trip of Beta Beta Beta Honor Society from Colegio Universitario de Cayey to El Verde.	-Advised governments and United States Department of Agriculture Forest Service in the Pacific Islands on mangrove ecology and research.	
-Reviewed a proposal to work on the endangered Puerto Rican Crested Toad for the Department of Natural Resources.	-Lectured at a special symposia celebrating H.T. Odum's 65th birthday, Chapel Hill, North Carolina.	
-Lectured at the 3rd Symposium on the Guánica Dry Forest, sponsored by the University of Puerto Rico, Ponce campus.	-Lectured at the University of Wisconsin on distributional patterns of West Indian birds.	
-Advised the Institute of Ecotechnics on forest insects.	-Lectured at Woods Hole on the status of migrant landbirds in the Caribbean.	
-Advised the Puerto Rican legislature on *Solenopsis invicta.*	-Participated in Long Term Ecological Research annual meeting.	

Table 1. (cont'd).

Commonwealth of Puerto Rico	National	International
-Organized and led many field trips to Luquillo Experimental Forest.	-Presented paper to the Ecological Society of America.	
-Consultation with the U.S. Navy concerning their reforestation projects in Vieques.	-Participated in Line Planting Workshop in Atlanta.	
-Hosted a group of visitors from Trinidad and Tobago.	-Participated in tropical forestry seminar of the Rainforest Alliance, New York.	
-Slide presentation on tropical forestry at Interamerican University.		
-Led Caribbean National Forest team in preparation of demonstration plan for the Forest.		
-Technology transfer to the Forestry Division of the Department of Natural Resources of Puerto Rico.		

Table 2. Committees or delegations with Institute staff participation.

Commonwealth of Puerto Rico	National	International
-Graduate student committees at the University of Puerto Rico.	-U.S. MAB Program, Executive Committee.	-Research Committee of FAO's Latin America Forestry Committee.
-Coordinator, Big Tree Registry for Puerto Rico.	-Puerto Rican Parrot Inter-Agency Working Group Committee.	-Advisory Committee for UNESCO MAB Program in Paris.
-Puerto Rican Parrot Research Subcommittee.	-Population Viability Analysis Workshop for the Puerto Rican Parrot and Puerto Rican Plain Pigeon.	-Caribbean Foresters Society.
	-Long Term Ecological Research Coordinating Committee.	-FAO North American's working group.
	-Publications of the Year Committee for the Southern Forest Experiment Station.	-Delegation to overview Forestry and National Parks in Malaysia.

Table 3. Visitors to the Institute of Tropical Forestry.

Adair, Kent
Stephen F. Austin State University
Nacogdoches, Texas

Adams, Stanford
USDA Forest Service
Atlanta, Georgia

Alvarez Ruiz, M.
Ponce, Puerto Rico

Alvarez, Gloria
Levittown, Puerto Rico

Asbury, Clyde
Center for Energy and
Environment Research
San Juan, Puerto Rico

Ashton, Peter S.
Arnold Arboretum
Harvard University
Cambridge, Massachussetts

Attiwill, Peter
School of Botany
University of Melbourne
Australia

Beard, Bruce
OMB Budget Examiner
Washington, D.C.

Beasley, J. Lamar
USDA Forest Service
Asheville, North Carolina

Beasley, R. Scott
Monticello, Arkansas

Benson, Harold R.
Kentucky State University
Frankfort, Kentucky

Bhatt,S.S
Winrock International
Arlington, Virginia

Bisla, S.S.
Department of Forestry
Mississippi State University
Mississippi

Bloomfield, Janine
School of Forestry and Environmental
Studies
Yale University
New Haven, Connecticut

Boehnert, Joaquin
Food and Agriculture Organization
Dominican Republic

Bonsi, Conrad
G.W. Carver Agricultural Experiment Station
Tuskegee University
Alabama

Bowden, William B.
University of New Hampshire
Durham, New Hampshire

Box, Ben
Clemson University
Clemson, South Carolina

Bradley, James G.
Assistant to Bruce Vento
Washington, D.C.

Breazeale, Robert
Staff Assistant
Deputy Chief's Office for
State and Private Forestry
Washington, D.C.

Table 3. (cont'd)

Buchman, Robert E.
Oregon State University
International Union of Forest
Research Organizations
Corvallis, Oregon

Callahan, Jack N.
USDA Forest Service
Atlanta, Georgia

Carn, Joanne M.
Santurce, Puerto Rico

Carn, Joseph L.
Santurce, Puerto Rico

Carpenter, Stanley B.
Louisiana State University
Baton Rouge, Louisiana

Certain, David L.
University of Oklahoma
Norman, Oklahoma

Chappell, Thomas
USDA Forest Service
Atlanta, Georgia

Chinea, Jesus Danilo
Rio Piedras, Puerto Rico

Christen, Catherine
Johns Hopkins University
Baltimore, Maryland

Cintron, Barbara B.
Department of Natural Resources
San Juan, Puerto Rico

Collier, Nola
Tobago House of Assembly
Trinidad and Tobago

Covich, Alan P.
University of Oklahoma
Norman, Oklahoma

Cruz, Alex
University of Colorado
Boulder, Colorado

Dance, Jose C.
Universidad Nacional Autonoma
La Molina
Lima, Peru

Delgado, Jorge A.
Bayamon, Puerto Rico

Dhall, S.P.
College of Forestry
University of Idaho
Moscow, Idaho

Doolittle, Warren T.
International Society of Tropical Foresters
Bethesda, Maryland

Ellis, Thomas H.
USDA Forest Service
Southern Forest Experiment Station
New Orleans, Louisiana

Ellwood, Eric
North Carolina State University
Raleigh, North Carolina

Erickson, John
USDA Forest Service
Madison, Wisconsin

Evans, Tara
St. Thomas, Virgin Islands

Table 3. (cont'd)

Ewel, John
University of Florida
Gainesville, Florida

Fernandez-Cuervo, Ileana
Santurce, Puerto Rico

Fetcher, Ned
Deptartment of Biology
University of Puerto Rico
Rio Piedras, Puerto Rico

Fierro, Chuck
USDA Forest Service
New Orleans, Louisiana

Finley, Amy
Center for Energy and
Environment Research
San Juan, Puerto Rico

Fugalli, Oscar
International Union of Forest
Research Organizations
Vienna, Austria

Fuster, Jaime B.
Puerto Rican Resident Commissioner
Washington, D.C.

Genberg, Pat
USDA Forest Service
New Orleans, Louisiana

Gilliam, Conrad
Virginia State University
Virginia

Gopikuman, K.
Department of Forestry
University of Florida
Gainesville, Florida

Grubb, Peter
Botany School
Cambridge, United Kingdom

Grut, M.
The World Bank
Washington, D.C.

Hall, Charles
SUNY Environmental
Science and Forestry

Harcharik, David
USDA Forest Service
International Forestry
Washington, D.C.

Hartness, Norm
Special Assistant to Associate Director
for Natural Resources Energy and Science

Heaton, Kate
School of Forestry and Environmental
Studies
Yale University
New Haven, Connecticut

Hillgartner, Bill
Johns Hopkins University
Baltimore, Maryland

Hirsch, Regina
School of Forestry and Environmental
Studies
Yale University
New Haven, Connecticut

Holdridge, Elliot C.
Washington, D.C.

Table 3. (cont'd)

Holdridge, L.R.
Tropical Resource Center
San Jose, Costa Rica

Hosner, John
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia

Hough, Walt
USDA Forest Service
New Orleans, Louisiana

Hubbell, Stephen P.
Department of Biology
Princeton University
Princeton, New Jersey

Hughes, Jeffrey
Department of Botany
University of Vermont
Burlington, Vermont

Hunter, Arthur Gene
Petionville, Haiti

Hunter, Kathryn
USDA Forest Service
Takoma Park, Maryland

Hunter, Tom
England

Huyke, Heather
Washington, D.C.

Jadhav, B.B.
Forest Science
Texas A & M University
Texas

Jahn, Laurence R.
Vienna, Virginia

Johnson, Dennis
USDA Forest Service
International Forestry
Washington, D.C.

Jones, Leroy
Deputy Regional Forester
State and Private Forestry, Region 8
Atlanta, Georgia

Jordan, Carl
Institute of Ecology
University of Georgia
Athens, Georgia

Kangas, Pat
Biology Department
East Michigan University
Ypsilanti, Michigan

Keogh, Raymond
Irish Forestry Board
Food and Agriculture Organisation
Consultant
Ireland

Khan, M.A.
Department of Plant Pathology
Virginia Polytechnic Institute & State
University
Blacksburg, Virginia

Khangra, Bipin
Department of Forestry
University of Florida
Gainesville, Florida

Table 3. (cont'd)

Kilpatrick, Kran
Nepal Coppice Reforestation
Kathmando, Nepal

Kitchens, Bobby
USDA Forest Service
Atlanta, Georgia

Kolterman, Duane A.
Department of Biology
Recinto Universitario de Mayaguez
Mayaguez, Puerto Rico

Lanly, Jean Paul
Food and Agriculture Organization
Rome, Italy

Lee, J. Charles
Dept. of Forest Science
Texas A & M. University

Lentz, Robert
Director Cooperative Forestry
Staff Region 8
Atlanta, Georgia

Liegel, Leon H.
USDA Forest Service
Corvallis, Oregon

Lindell, Gary R.
Forest Products Laboratory
Madison, Wisconsin

Liogier, Henri E.
Botanical Garden
University of Puerto Rico
San Juan, Puerto Rico

Little Jr., Elbert L.
Retired Botanist, USDA Forest Service
Washington, D.C.

Loidy Angulo, B.
Estacion Experimental Forestal
Pucallpa, Peru

Lopez Soto, Richard
Bayamon, Puerto Rico

Lopez, Lourdes V.
San Juan, Puerto Rico

Lopez, Mary M.
Bayamon, Puerto Rico

Lovejoy, Thomas
Smithsonian Institution
Washington, D.C.

Lugo Lugo, Herminio
Rio Piedras, Puerto Rico

Madelain Romero
Center for Energy and
Environment Research
San Juan, Puerto Rico

Maldonado, Edwin D.
Cayey, Puerto Rico

Marrero, Jose
Rio Piedras, Puerto Rico

Martorell, Luis F.
Botanical Garden
University of Puerto Rico
Rio Piedras, Puerto Rico

Mayne, John C.
Department of Forestry
University of Florida
Gainesville, Florida

Table 3. (cont'd)

McConell, W.J.
Tallahassee, Florida

McCormick, Frank
University of Tennessee
Knoxville, Tennessee

McDowell, Bill
State University of New York
Oswego, New York

Meadows, John
CSRS-USDA
Washington, D.C.

Mealey, Stephen P.
USDA Forest Service
Washington, D.C.

Medina, Ernesto
Instituto Venezolano de
Investigaciones Cientificas
Caracas, Venezuela

Melillo, Jerry M.
The Ecosystems Center
Marine Biological Laboratory
Woods Hole, Massachussetts

Mercado, Nydia
Rio Piedras, Puerto Rico

Miller, Edwin
Oklahoma State University
Stillwater, Oklahoma

Misra K.K.
Department of Forestry
Virginia Polytechnic Institute & State
University
Blacksburg, Virginia

Molas F., Pedro J.
Asuncion, Paraguay

Naitam, N.R.
Entomology Department
Mississippi State University

Nema, A.G.
Virginia Polytechnic Institute & State
University
Blacksburg, Virginia

Newton, N.H.
Raleigh, North Carolina

Nichols, Vicki
School of Forestry and Environmental
Studies
Yale University
New Haven, Connecticut

Nieves, Luis O.
Department of Biology
University of Puerto Rico
Humacao, Puerto Rico

Odum, H.T.
University of Florida
Gainesville, Florida

Orlen, Allan P.
State University of New York
Syracuse, New York

Parham, Walter
Office of Technology Assessment
U.S. Congress
Washington, D.C.

Pool, Douglas
Development Alternatives, Inc.
Washington, D.C.

Table 3. (cont'd)

Pretsch , Jurgen
Mision Forestal Alemana
Asuncion, Paraguay

Raid , M. James
The Ecosystems Center
Marine Biological Laboratory
Woods Hole, Massachussetts

Reed, Hazell
Pine Bluff, Arkansas

Regis, Guito
Port-au-Prince, Haiti

Richter, Carolyn
Ithaca, New York

Robertson, Dale
Chief of the USDA Forest Service
Washington, D.C.

Rodriguez, Nahir
Trujillo Alto, Puerto Rico

Ross, Eldon W.
USDA Forest Service
Washington, D.C.

Roussopoulos, Peter
USDA Forest Service,
Research, Washington Office
Washington, D.C.

Ruiz, Blanca
Department of Natural Resources
San Juan, Puerto Rico

Salinas, Jose
USDA Forest Service
Bismarck, North Dakota

Sampson, R. Neil
Alexandria, Virginia

Sanchez, Aixa
San Juan, Puerto Rico

Schultz, Robert
USDA Forest Service
New Orleans, Louisiana

Sesco, Jerry A.
USDA Forest Service
Research, Washington Office
Washington, D.C.

Siccama, Tom
School of Forestry and Environmental Studies
Yale University
New Haven, Connecticut

Siddiqni, Manauwar H.
Forest Science Department
Texas A. & M. University

Simmons, Nick
Los Angeles, California

Simpson, Octeris
Langston University
Langston, Oklahoma

Singh, Sohan
College of Wildlife and Range Sciences
University of Idaho
Moscow, Idaho

Smith, Howard
Humacao, Puerto Rico

Table 3. (cont'd)

Smythe, Dick
USDA Forest Service
Washington, D.C.

Sojer, Jeff
International Union for Conservation of Nature and Natural Resources
Gland, Switzerland

Steudler, Paul A.
Ecosystems Center
Marine Biological Laboratory
Woods Hole, Massachussetts

Stone, Tom
Woods Hole Research Center
Woods Hole, Massachussetts

Suarez , Javier
Caracas, Venezuela

Suarez Delgado, Rafael Angel
Ponce, Puerto Rico

Sullivan, Neal
University of New Hampshire
Durham, New Hampshire

Teate, Lamar
Louisiana Tech University
Ruston, Louisiana

Thompson, Emmett
Auburn University
Auburn, Alabama

Thompson,Warren
Mississippi State University

Timyan, Joel
Petionville, Haiti

Torrent, Fernando
Guaynabo, Puerto Rico

Trim, William A.
Forestry Section
Tobago House of Assembly
Scarborough, Tobago

Unda, Alfredo
Petionville, Haiti

Vento, Bruce
U.S. Congressman
Washington, D.C.

Vera, Ana M.
Department of Natural Resources
Natural Heritage Program
San Juan, Puerto Rico

Villarrubia Cruz, Jose
Recinto Universitario de Mayaguez
Mayaguez, Puerto Rico

Vincent, Jeff
Department of Forestry
Michigan State University
East Lansing, Michigan

Vogt, Kristina
School of Forestry and Environmental Studies
Yale University
New Haven, Connecticut

Waide, Jack B.
Forest Hydrology Laboratory
Oxford, Massachussetts

Table 3. (cont'd)

Waide, Robert
Center for Energy and Environment Research
San Juan, Puerto Rico

Washington, Heyward B.
USDA Forest Service
Atlanta, Georgia

Weaver, George T.
Department of Forestry Wildlife and Fishery
University of Tennessee
Knoxville, Tennessee

Webb, Burley
A & T State
North Carolina

Wencelius, F.
The World Bank
Washington, D.C.

Wentworth, T.R.
North Carolina State University
Raleigh, North Carolina

Whitmore, T. C.
Oxford Forestry Institute
Oxford, United Kingdom

Youxu Jiang
The Chinese Academy of Forestry
China

Zarin, Daniel
School of Forestry and Environmental Studies
Yale University
New Haven, Connecticut

Zinke, Paul
University of California
Berkeley, California

INSTITUTE OF TROPICAL FORESTRY

Funded in 1939. Parent organization: USDA Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana. Mailing address: USDA Forest Service, Institute of Tropical Forestry, Call Box 25000, Río Piedras, Puerto Rico 00928-2500. Physical address: Río Piedras to Caguas Road, Agriculture Experimental Station Grounds, Río Piedras, Puerto Rico. Phone: (809) 766-5335, FTS: 498-5335, FAX: (809) 250-6924.

HISTORY: Initially designated an Experiment Station by Act of Congress (McSweeney-McNary Forest Research Act of 1928). Designated as the Tropical Forest Experiment Station in 1939; and Institute of Tropical Forestry in 1961. The Unit reported to Washington, D.C. until 1978 when it was transferred to the Southern Forest Experiment Station. Known as Research Work Unit SO-1152 (1978-1985) and as SO-4151 since 1985.

DIRECTORS: Arthur Bevan (1939-1943), Arthur T. Upson (1943-1951), Henry B. Bosworth (1951-1953), I.P. Murray (Administrator 1953-1955), Frank H. Wadsworth (Research Center Leader 1949-1956, Director 1956-1978), Ariel E. Lugo (Project Leader 1978-present, Director 1988-present).

SCIENTISTS (current staff in italics): C.B. Briscoe, R.S. Boone, M. Chudnoff, T.R. Crow, G.H. Englerth, *J.K. Francis,* T.F. Geary, L.H. Holdridge, J. Kalina, A. Krochmal, F.B. Lamb, L.H. Liegel, *A.E. Lugo*, F.R. Longwood, J. Marrero, *F.N. Scatena*, T.H. Schubert, *J. Torres*, C.R. Venator, *F.H. Wadsworth, P.L. Weaver, J. Wunderle*, J.L. Whitmore.

VISITING SCIENTISTS FOR >1 YEAR: S. Brown, J.L. Frangi, A. Gillespie, E. Medina, E. Cuevas, J.F. McCormick, H.T. Odum.

RESEARCH PROGRAM: The Institute has programs in five areas: (1) plantation management; (2) secondary forest management; (3) management of endangered wildlife; (4) management of watersheds; and (5) technology transfer and dissemination of information. In addition the Institute has a large cooperative research program including: Long Term Ecological Research (NSF), Soil Biology and Fertility (IUBS), Global Carbon Cycle (DOE), and Pine Growth in the Caribbean and Central America (US AID).

INSTITUTIONAL COLLABORATORS:

Governments

Ministry of Agriculture, Antigua; Ministry of Agriculture, Barbados; Ministry of Agriculture, Lands, and Fisheries, Dominica; Ministry of Agriculture, Jamaica; Ministry of Agriculture, Lands and Fisheries, Saint Lucia; Ministry of Trade and Agriculture, Saint Vincent & the Grenadines; Ministry of Agriculture Lands, and Food Production, Trinidad and Tobago.

International Organizations

Caribbean Area Management Institute; Food and Agriculture Organization; International Union of Forest Research Organizations; UNESCO Man and the Biosphere Program.

U.S. Federal Agencies

Caribbean National Forest; Department of State Man and the Biosphere Program; Fish and Wildlife Service; Geological Survey ; National Park Service; Office of Technology Assessment; Peace Corps.

Agencies of the Commonwealth of Puerto Rico

Department of Natural Resources; University of Puerto Rico, including its many dependencies such as: Center for Energy and Environment Research, Agricultural Experiment Station, Biology Departments in all campuses, the Botanical Garden, Center for Resources for Science and Engineering, and others.

State Agencies

North Carolina Agriculture Research Service

Agencies of Foreign Governments

Venezuelan Institute of Scientific Investigations

Universities

Alacala de Henares, Madrid; Colorado, Boulder; Florida, Gainesville; Georgia, Athens; Michigan State, East Lansing; Missouri, Colombia; New York, Syracuse; Yale, New Haven; Pennsylvania, Philadelphia; Puerto Rico, Rio Piedras; Tennessee, Knoxville; Wisconsin, Madison; Wageningen, Netherlands (Holanda).

Private Institutions

Institute of Ecosystem Studies; Island Research Foundation; Montserrat National Trust; Boy Scouts of America; International Society of Tropical Foresters

AWARDS:

Superior Service Award, United States Department of Agriculture (1964 1985, 1989);

Luquillo Experimental Forest designated a Biosphere Reserve under the UNESCO Man and the Biosphere Program (1976);

Meritorious Service Award, United States Department of Agriculture Forest Service, 1979.

Special Award of Merit, United States Environmental Protection Agency (1980);

Technician Public Service Award, Southern Forest Experiment Station, United States Department of Agriculture, Forest Service (1988);

Unit Civil Rights Award, Southern Forest Experiment Station, United States Department of Agriculture, Forest Service (1988);

Distinguished Service Award, United States Department of Agriculture (1988)

Global 500 Award,United Nations Environment Programme (1989);

RESEARCH ACCOMPLISHMENTS:

Provided the technical basis for national land use planning of the island (urban, cultivation, pasture, other permanent cover crops, timber forest, and protective forest), using criteria applicable regionally.

Determined by years of experimentation the best tree species for reforesting degraded lands in Puerto Rico, the Virgin Islands, and neighboring countries.

Perfected seed, nursery, and planting practices for the most promising tree species for reforestation and for timber production in the Caribbean region.

Published illustrated descriptions of the entire tree flora of Puerto Rico and the Virgin Islands, some 750 species, mostly also of regional significance.

Characterized the physical and machining properties of more than 100 of the most useful woods of Puerto Rico and the Caribbean.

Determined untreated service life for fence posts of 40 tree species typical of the region and practical cold-soaking and hot-and-cold bath preservative treatments to extend their service life up to tenfold.

Recorded data on the growth rates of more than 100 tree species native to the six life zones represented in Puerto Rico and common throughout the Caribbean, from wet to dry, relative to tree size, canopy position, and other conditions, as a basis for silvicultural stand improvement for increased yields.

For 20 years inaugurated and sustained the research that rescued the Puerto Rican parrot from almost certain extinction, a bird representative of other endangered parrots in the tropics.

Adapted a solar drier for the rapid seasoning of lumber under tropical conditions. Has been copied in other countries.

Developed an incisor making possible penetration of wood preservatives into relatively impervious woods otherwise suitable as fence posts.

Participated in all but one of the sessions of the FAO Latin American Forestry Commission and chaired Regional Committee on Forestry Research since its inception.

Edited a regional bilingual technical forestry journal, The Caribbean Forester, for 24 years and the bilingual worldwide newsletter of the International Society of Tropical Foresters for 10 years.

Produced more than 500 published technical papers on tropical forestry of regional significance.

Provided professional consultants on request for tropical forestry problems in Mexico, Costa Rica, British Virgin Islands, St. Kitts, Antigua, Montserrat, Dominica, Dominican Republic, Haiti, Jamaica, St. Lucia, St. Vincent, Grenada, Trinidad and Tobago, Venezuela, Colombia, Ecuador, Peru, Brazil, Paraguay, Argentina, the U.S. Virgin Islands, and Malaysia.

Published an analytical comparison of the growth performance of forest plantations in different life zones throughout the tropics.

Defined, mapped, and published descriptions of the Holdridge life zones throughout Puerto Rico and Brazil.

Developed a library on tropical forestry, possibly the best of its kind in the hemisphere.

Participated in detailed studies of the dynamics of subtropical wet and dry and lower montane forest ecosystems in Puerto Rico, representative of many other forest in the Caribbean.

Analyzed the forest biomass of the entire tropics and its significance to the global carbon budget.

Completed two forest inventories of Puerto Rico, one in the island of St. Vincent, and described and mapped the vegetation of St. John, U.S. Virgin Islands.. The techniques are generally applicable to the region.

Assessed the damage of hurricane David to the forests of Dominica, producing observations of significance throughout the West Indies.

Chaired the Tropical Forest Directorate of the Man in the Biosphere Program for many years.

Determined annual trends in the visitation of migrant birds from the continental United States over a period of 12 years.

Co-chaired Silvicultural Study Group of North American Forestry Commission for 23 years.

Completed comparative studies of the performance of Caribbean pine plantations in Puerto Rico, Trinidad, Venezuela, Jamaica, and Costa Rica.

Completed and published a bibliography of publications on forestry in Puerto Rico over a period of more than a century.

Completed and published comparative studies of the birds of the Antilles.

Published studies of enrichment planting with mahogany showing results applicable throughout the region.

Developed an arboretum of native and exotic tropical timber tree species useful throughout the American tropics.

Developed an herbarium with 400 of the native tree species of Puerto Rico and the Virgin Islands most of which are also in the forests of neighboring islands of the Caribbean.

Developed satisfactory techniques for the line planting of West Indies mahogany on St. Croix in dry forests representative of many other Caribbean islands.

Conducted a survey of the exotic tree species that have naturalized in Puerto Rico.

Written detailed silvical descriptions of more than 40 tree species of importance to Puerto Rico and the region.

Collected and sent tree seed samples to researchers and managers in dozens of countries.

PUBLICATIONS (*Indicates reprints available for distribution)
PUBLICACIONES (Indicación de reimpresos disponibles para distribución).

1939

Holdridge, L.R. Forestry in Puerto Rico. Caribbean Forester 1(1):7-11.

1940

Holdridge, L.R. *Calophyllum antillanum*, a desirable tree for difficult planting sites. Caribbean Forester 1(2):27-28.

Holdridge, L.R. A rapid method for extracting balsa seed. Caribbean Forester 1(2):25.

Marrero, J. Conservacion. Caribbean Forester 1(2):17-24.

1942

Bevan, A. Farm forestry in Puerto Rico. Revista de Agricultura, Industria y Comercio 34(1):79-81.

Holdridge, L.R. Trees of Puerto Rico. Volume I. United States Forest Service, Tropical Forest Experiment Station Occasional Paper 1. 105 p.

Holdridge, L.R. Trees of Puerto Rico. Volume II. United States Forest Service, Tropical Forest Experiment Station Occasional Paper 2. 104 p.

Marrero, J. A seed storage study of maga. Caribbean Forester 3(4):173-184.

Marrero, J. Study of grades of broadleaved mahogany planting stock. Caribbean Forester 3(2):79-88.

1943

Bevan, A. A forest policy for the American tropics. Caribbean Forester 4(2):49-53.

Holdridge, L.R. Arboles de Puerto Rico. Volume I. - Translation of previously published "Trees of Puerto Rico" Volume I. United States Forest Service, Tropical Forest Experiment Station, Río Piedras, Puerto Rico.

Holdridge, L.R. Arboles de Puerto Rico. Volume II. - Translation of previously published "Trees of Puerto Rico" Volume II. United States Forest Service, Tropical Forest Experiment Station, Río Piedras, Puerto Rico.

Marrero, J. A seed storage study of some tropical hardwoods. Caribbean Forester 4(3):99-106.

Wadsworth, F.H. The evaluation of forest tree species in Puerto Rico, as affected by the local forest problem. Caribbean Forester 4(2):54-58.

Wadsworth, F.H. The Las Cobanitas campeche plantation. Caribbean Forester 4(3):140-143.

Wadsworth, F.H. Lightning damage to ponderosa pine stands in the Southwest. Journal of Forestry 41(9):684-685.

Wadsworth, F.H. Pomarrosa, *Jambosa jambos* (L.) Millsp. and its place in Puerto Rico. Caribbean Forester 4(4):183-194.

Wadsworth, F.H. Roble, a valuable forest tree in Puerto Rico. Caribbean Forester 4(2):59-76.

1944

Marrero, J. Utilización de la caña guadua en Ecuador. Caribbean Forester 5(3):145-151.

Wadsworth, F.H. The development of a maría plantation on a poor site. Caribbean Forester 5(4):207-211.

Wadsworth, F.H. The first year in the Cambalache Experimental Forest. Caribbean Forester 6(1):34-38.

Wadsworth, F.H. and J.B. Gaztambide. Forestry in the coffee region of Puerto Rico. Caribbean Forester 6(1):71-75.

1945

Upson, A. The experience of the Forest Service in its Land Purchase Program. *In* paper presented at Institute of Land Value Problems, November 1945, Mayaguez, Puerto Rico. Office of the Governor, San Juan, Puerto Rico.

Upson, A. Forests and land tenure in Puerto Rico. *In* paper presented at Land Tenure Conference, September 1944, Mayaguez, Puerto Rico. Caribbean Research Council of Anglo-American Caribbean Commission.

Wadsworth, F.H. El Bosque Experimental de Cambalache, un beneficio para la comunidad. Revista de Agricultura de Puerto Rico 36(2):139-144.

Wadsworth, F.H. Further notes on the regeneration and growth of *Tabebuia pallida* Miers. Caribbean Forester 6(4):267-270.

Wadsworth, F.H. The potentialities of forestry on Mona Island. Caribbean Forester 6(4):219-244.

1946

García-Piquera, C. A Spanish-English glossary of forestry terminology. Caribbean Forester 7:103-120.

Marrero, J. El cultivo de Eucalypto en la sierra de Ecuador. Caribbean Forester 7:57-69.

Upson, A. Forests and tenure in Puerto Rico. Caribbean Land Symposium. Pages 233-244 *in* Bulletin of Caribbean Commission, Commission on Agriculture, Nutrition, Fisheries and Forestry of the Caribbean Research Council, Washington, DC, USA. [In English with summaries in English, Spanish, French and Dutch].

Upson, A. The mountain area defined, its present and possible future tenure relationships. *In* paper given at Conference on Problems of the Mountain Area of Puerto Rico, June 6-8, 1946, San Juan, Puerto Rico.

Upson, A. Statement of policy and objectives governing the forest lands of the people of Puerto Rico. [Published (without authorship) in Spanish. Pages 113-122 *in* L.A. Izquierdo. Ideología, Programas y Actividades. Department of Agriculture and Commerce, San Juan, Puerto Rico].

Wadsworth, F.H. La influencia climatológica e hidrológica de los bosques. Revista de Agricultura de Puerto Rico 38:83-87. [English: Caribbean Forester 8(4):289-293; also Spanish, p. 294-298 in 1947].

1947

García-Piquera, C. A Spanish-English glossary of forestry terminology, II. Caribbean Forester 8:45-64.

García-Piquera, C. A Spanish-English glossary of forestry terminology, III. Caribbean Forester 8:269-286.

Marrero, J. Efecto de la poda radicular de dos especies forestales. Caribbean Forester 8:241-244.

Marrero, J. The proper depth and kind of covering for seeds of several tropical hardwoods. Caribbean Forester 8:213-236.

Marrero, J. A survey of the forest plantations in the Caribbean National Forest. M.F. Thesis. School of Forestry and Conservation, University of Michigan, Ann Arbor, Michigan, USA. 167 p. + maps.

Wadsworth, F.H. An approach to silviculture in tropical America and its application in Puerto Rico. Caribbean Forester 8(4):245-256. [Spanish translation, p. 257-267. Also in Caribbean Commission Monthly Bulletin 1(11):17-21 (in 1948). Portuguese translation in Boletim da Secretaria de Agricultura, Industria e Comercio (Brazil, in 1949)].

Wadsworth, F.H. The development of *Swietenia mahagoni* Jacq. on St. Croix. Caribbean Forester 8:161-162. [Spanish translation, p. 162-164].

Wadsworth, F.H. Growth in the lower montane rain forest of Puerto Rico. Caribbean Forester 8:27-35. [Spanish translation, p. 35-43].

Wadsworth, F.H. The influence of forest upon climate and water behavior. Caribbean Forester 8(4):289-293. [Spanish translation, p. 294-298].

Wadsworth, F.H. The second year in the Cambalache Experimental Forest. Caribbean Forester 8(2):65-70. [Spanish translation, p. 162-164].

Wadsworth, F.H. The third year in the Cambalache Experimental Forest. Caribbean Forester 8(3):203-207. [Spanish translation, p. 207-212].

1948

García-Piquera, C. A Spanish-English glossary of forestry terminology, IV. Caribbean Forester 9:15-43.

Marrero, J. Contribución de la zona cafetalera a las necesidades forestales y a las fuentes fluviales de Puerto Rico. Revista del Café 3(9):10.

Marrero, José. Forest planting in the Caribbean National Forest, past experience as a guide for the future. Caribbean Forester 9:85-213.

Upson, A. Problemas poblacionales y de migración de la zona cafetalera. Revista del Café 3(9):11-14.

Upson, A. and F.H. Wadsworth. The development of forest land management in Tropical America. *In* paper presented at Interamerican Conference on Conservation of Renewable Natural Resources, September 1948. Denver, Colorado, USA.

Wadsworth, F.H. The climate of the Luquillo Mountains and its significance to the people of Puerto Rico. Caribbean Forester 9(4):321-335. [Spanish translation, p. 336-344. Also presented to the Puerto Rico Chapter of Sociedad Americana de Ciencias Agrícolas at Mayaguez, Puerto Rico. October 1948].

Wadsworth, F.H. Five years of forest research on the north coast of Puerto Rico. Caribbean Forester 9(4):373-376. [Spanish translation, p. 376-380].

Wadsworth, F.H. Silviculture in tropical America and Puerto Rico. Caribbean Commission Monthly Bulletin 1(11):17-21.

1949

Marrero, J. Tree seed data for Puerto Rico. Caribbean Forester 10:11-36.

Marrero, J. What are the uses of farm forest tree species? Caribbean Forester 10:249-252.

Marrero, J. What tree species are adapted to farm forest lands? Caribbean Forester 10:244-248.

Wadsworth, F.H. Angel Monserrate's forest. Caribbean Forester 10(1):1-7. [Spanish translation, p. 7-10. Also in Revista de Agricultura de Puerto Rico 40:164-169; and in Mensajero Forestal (Mexico) 8(72):10-13 (in 1950)].

Wadsworth, F.H. How should farm forests be managed? Caribbean Forester 10:253-259. [Spanish translation, p. 292-298].

Wadsworth, F.H. What kind of land is adapted to trees? Caribbean Forester 10(4):243. [Spanish translation, p. 281].

Wadsworth, F.H. What will be the returns from farm forestry? Caribbean Forester 10:259-266. [Spanish translation, p. 298-306].

Wadsworth, F.H. and E. Solis. Population and employment problems in the Toro Negro Forest. Caribbean Forester 10(1):59-68. [Spanish translation, p. 69-79. Also in Revista de Agricultura de Puerto Rico 40:156-163].

1950

García-Piquera, C. A Spanish-English glossary of forestry terminology, V. Caribbean Forester 11(1):25-37.

Marrero, J. Reforestation of degraded lands in Puerto Rico. Caribbean Forester 11(1):3-15.

Marrero, J. Results of forest planting in the insular forests of Puerto Rico. Caribbean Forester 11(3):107-147. [Spanish translation, p. 151-195].

Wadsworth, F.H. El bosque de Angel Monserrate. Mensaje Forestal (Mexico) 8(72):10-13.

Wadsworth, F.H. Notes on the climax forests of Puerto Rico and their destruction and conservation prior to 1900. Caribbean Forester 11(1):38-47. [Spanish translation, p. 298-306].

1951

Marrero, J. and F.H. Wadsworth. Early results from the improvement of a farm woodlot. Caribbean Forester 12(2):59-62. [Spanish translation, p. 62-66].

Wadsworth, F.H. Como puede ayudar el técnico forestal al cafetalero? Revista del Café 6(11):11-15.

Wadsworth, F.H. El cultivo forestal como una práctica de conservación de suelos en Puerto Rico. Revista de Agricultura de Puerto Rico 42(1-2):127-132.

Wadsworth, F.H. Forest management in the Luquillo Mountains, I. Caribbean Forester 12(3):93-114. [Spanish translation, p. 115-132].

Wadsworth, F.H. Soil as a factor in the occurrence of two types of montane forest in Puerto Rico. Caribbean Forester 12(2):67-70. [Spanish translation, p. 70-74].

1952

Wadsworth, F.H. Forest management in the Luquillo Mountains: II. Planning for multiple land use. Caribbean Forester 13(2):49-61. [Spanish translation, p. 62-74].

Wadsworth, F.H. Forest management in the Luquillo Mountains: III. Selection of products and silvicultural policies. Caribbean Forester 13(3):93-119. [Spanish translation, p. 120-142].

Wadsworth, F.H. Inter-American action to conserve forests. The Department of State Bulletin 27:492-495.

1953

Wadsworth, F.H. and J. Marrero. The significance to Puerto Rico of Companhia Paulista experience with *Eucalyptus*. Caribbean Forester 14(1-2):65-78. [Spanish translation, p. 79-91].

Wadsworth, F.H. New observations of tree growth in tabonuco forest. Caribbean Forester 14(3-4) :106-111.

Wadsworth, F.H. Our efforts to conserve trees. Caribbean Forester 14(3-4):140-145.

1954

Marrero, J. Especies del género *Inga* usadas como sombra de café en Puerto Rico. Caribbean Forester 15:54-71.

Wadsworth, F.H. Tropical rain forest. Pages 119-129 *in* Volume III, Proceedings of the Fourth World Forestry Congress. Dehra Dun, India.

1955

Longwood, F.R. Industrial wood use in Puerto Rico. Caribbean Forester 16(3-4):64-97.

Wadsworth, F.H., B.J. Huckenpahler, and C.R. Ehelebe. A report on the tropical forestry short course held in Puerto Rico, March 1 to May 29, 1955. Caribbean Forester 16(1-2):12-23. [Spanish translation, p. 24-35].

1957

Huckenpahler, B.J. Report on the fourth tropical forestry short course. Caribbean Forester 18(1-2):12-23. [Spanish translation, p. 24-35].

1958

Marrero, J. and F.H. Wadsworth. Indicaciones para la repoblación forestal de las fincas de Puerto Rico. Caribbean Forester 19(3-4):56-79.

1959

Briscoe, C.B. Statistically valid planting trials. Paper presented *in* Second Eucalyptus Conference. Sao Paulo, Brazil.

Briscoe, C.B. Early results of mycorrhizal inoculation of pine in Puerto Rico. Caribbean Forester 20(3-4):73-77.

Briscoe, C.B. and A.P. DuBarry, Jr. A simplified germination test for American sycamore. United States Forest Service Tree Planters' Notes No. 35.

*Englerth, G.H. Air drying conditions for lumber in the San Juan area. United States Forest Service, Tropical Forest Research Center, Tropical Forest Note 1. 2 p.

Lamb, F.B. Prospects for forest land management in Panama. Tropical Woods 110:16-28.

Lamb, F.B. The coastal swamp forests of Nariño, Colombia. Caribbean Forester 20(3-4):79-89.

Lamb, F.B. A selected annotated bibliography on mahogany. Caribbean Forester 20(1-2):17-37.

Lamb, F.B. The 1959 tropical forestry training course. Caribbean Forester 20(1-2):11-16.

Wadsworth, F.H. Growth and regeneration of white mangrove in Puerto Rico. Caribbean Forester 20(3-4):59-71.

Wadsworth, F.H. and G.H. Englerth. Effects of the 1956 hurricane on forests in Puerto Rico. Caribbean Forester 20(1-2):38-51.

1960

Briscoe, C.B. Lifting pine seedlings. United States Forest Service, Tropical Forest Research Center, Tropical Forest Note 3. 2 p.

Englerth, G.H. Service life of some Puerto Rican fence post species tested with ten percent pentachlorophenol by cold soaking. Caribbean Forester 21(1-2):38-40.

Englerth, G.H. The service life of untreated posts in Puerto Rico after one year in test. United States Forest Service, Tropical Forest Research Center, Tropical Forest Note 5. 2 p.

Englerth, G.H. and E. Goytía Olmedo. Preservation of Puerto Rican fence posts treated by cold soaking and the hot-and-cold bath method. United States Forest Service, Tropical Forest Research Center, Tropical Forest Note 2. 4 p.

Lamb, F.B. An aproach to mahogany tree improvement. Caribbean Forester 21(1-2):12-20.

Lamb, F.B., C.B. Briscoe, and G.H. Englerth. Recent observations on forestry in tropical America. Caribbean Forester 21(1-2):46-59.

Nobles, R.W. Forestry in the U.S. Virgin Islands. Journal of Forestry 58:524-527.

Sposta, J.W. Chemical removal of inferior tropical tree species. United States Forest Service, Tropical Forest Research Center, Tropical Forest Note 4. 2 p.

Wadsworth, F.H. The regeneration of tropical forests by planting. Pages 1947-1952 *in* Volume III, Proceedings of the Fifth World Forestry Congress. Seattle, Washington, USA.

Wadsworth, F.H., editor. Records of forest plantation growth in Mexico, the West Indies, and Central and South America. Caribbean Forester 21 (Suppl.). 387 p.

1961

Briscoe, C.B. Effects of flooding acorns of cherrybark and nuttall oak acorns. Ecology 42(2):430-431.

Briscoe, C.B. Ensayos de plantación estadísticamente válidos. Caribbean Forester 22(3-4):64-68.

Briscoe, C.B. Measurement of tree growth in tropical forests. *In* Proceedings of the Tenth Pacific Science Congress, Hawaii. Pacific Science Association.

*Englerth, G.H. and E.D. Maldonado. Bamboo for fence posts. United States Forest Service, Tropical Forest Research Center, Tropical Forest Note 6. [Also in Spanish in United States Forest Service, Tropical Forest Research Center, Apuntes Forestales Tropicales ITF-6].

Longwood, F.R. Puerto Rican woods: their machining, seasoning and related characteristics. United States Department of Agriculture, Agriculture Handbook 205. 98 p.

*Maldonado, E.D. Peladora de postes de cadena ajustada. [Translation of "A tight chain post peeler" by W.N. Darwin]. Servicio Forestal de los Estados Unidos, Apuntes Forestales Tropicales ITF-8.

Maldonado, E.D. and G.H. Englerth. Sawmills and suppliers of wood in Puerto Rico. United States Forest Service Tropical Forest Note ITF-7. [Also in Spanish in Servicio Forestal de los Estados Unidos, Apuntes Forestales Tropicales ITF-7].

Marrero, J. Sphagnum moss as a medium for rooting pine seedlings. United States Forest Service Tropical Forest Note ITF-9. [Also in Spanish in Servicio Forestal de los Estados Unidos, Apuntes Forestales Tropicales ITF-9].

Marrero, J. Tamaño de las parcelas de ensayo en investigaciones de genética forestal. [Translation of "Plot size in forest genetic research" by Jonathan W. Wright and F. Dean Freeland, Jr.]. Caribbean Forester 22(3-4):79-83.

1962

Barres, H. Report on 1961 tropical forestry short course. Caribbean Forester 23(1):27-32.

*Briscoe, C.B. Early lifting of pine seedlings. United States Forest Service Tropical Forest Note ITF-10. 2 p.

Briscoe, C.B. Medición del crecimiento de los árboles en los bosques tropicales. Caribbean Forester 23(1):15-20.

*Briscoe, C.B. Tree diameter growth in the dry limestone hills. United States Forest Service Tropical Forest Note ITF-12. 2 p.

Briscoe, C.B. and F.B. Lamb. Leaf size in *Swietenia*. Caribbean Forester 23(2):112-115.

Briscoe, C.B. and J. Marrero. La repoblación forestal en las tierras de Puerto Rico. Revista de Agricultura de Puerto Rico 49(1):129-136.

*Briscoe, C.B. and R.W. Nobles. Height growth of mahogany seedlings. United States Forest Service Tropical Forest Note ITF-13. 2 p.

Englerth, G.H. and E. Goytía Olmedo. The bow saw for cutting tropical woods. United States Forest Service Tropical Forest Note ITF-11. 3 p.

*Longwood, F.R. Present and potential commercial timbers of the Caribbean with special reference to the West Indies, the Guianas, and British Honduras. United States Department of Agriculture, Agriculture Handbook 207.

*Maldonado, E.D. Solar radiation used to dry mahogany lumber in Puerto Rico. United States Forest Service Tropical Forest Note ITF-14. 5 p.

Maldonado, E.D. Durabilidad de postes tratados para su finca. Revista de Agricultura de Puerto Rico 49(1):165-168.

Maldonado, E.D. and E.C. Peck. Drying by solar radiation in Puerto Rico. Forest Products Journal 12(10):487-488.

Marrero, J. Prácticas usadas en los viveros de pinos de Puerto Rico. Caribbean Forester 23(2):87-99.

Sposta, J.W. The Luquillo Experimental Forest, Puerto Rico. Institute of Tropical Forestry, United States Forest Service. [Leaflet prepared for distribution to visitors, describing the forest].

Wadsworth, F.H. Los bosques de Puerto Rico. Revista de Agricultura de Puerto Rico 49(1):78-86. [Also in Revista del Café 12:13-20 (in 1965)].

1963

Belanger, R.P. and C.B. Briscoe. Effects of irrigating tree seedlings with a nutrient solution. Caribbean Forester 24(2):87-90.

Briscoe, C.B. Rooting cuttings of cottonwood, willow, and sycamore. Journal of Forestry 61(1):51-53.

Briscoe, C.B. Weather in the Luquillo mountains of Puerto Rico. *In* Proceedings of the Third Technical Conference on Hurricanes and Tropical Meteorology, Mexico, D.F., Mexico.

Briscoe, C.B., J.R. Harris, and D. Wykoff. Variation of specific gravity in plantation-grown trees of bigleaf mahogany. Caribbean Forester 24(2):67-74.

Ewel, J.J. Height growth of bigleaf mahogany. Caribbean Forester 24(1):34-35.

Kumme, K.W.O. and C.B. Briscoe. Forest formations of Puerto Rico. Caribbean Forester 24(2):57-66.

Vozzo, J.A. and C.B. Briscoe. Response of Honduras pine to various photoperiods. Caribbean Forester 24(1):53-55.

White, H.H., Jr. Variation of stand structure correlated with altitude, in the Luquillo mountains. Caribbean Forester 24(1):46-52.

1964

*Barres, H. Rooting media for growing pine seedlings in hydroponic culture. Institute of Tropical Forestry Research Note No. 2. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 4 p.

Briscoe, C.B. and M. Chudnoff. Counting tree growth rings moderately difficult to distinguish. United States Forest Service Research Note ITF-1. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 2 p.

Chudnoff, M. and E.D. Maldonado. Preservative treatments and service life of fence posts in Puerto Rico. United States Department of Agriculture, Forest Service Research Paper ITF-1. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 22 p.

Little, E.L., Jr. and F.H. Wadsworth. Common trees of Puerto Rico and the Virgin Islands. United States Department of Agriculture, Agriculture Handbook 249. 527 p. [Published also in Spanish in 1967 by the University of Puerto Rico Press. This was reprinted privately by the authors and is for sale directly from them for $16].

1965

Barres, H. Effects of root exposure on Honduras pine planting stock. Turrialba 15(4):348-349.

Briscoe, C.B. Initial field testing for forest tree improvement. Journal of the Oxford University Forestry Society (Series 5) 13:16-21.

Marrero, J. Effect of a plastic mulch on weed growth and early height growth of Honduras pine. United States Forest Service Research Note ITF-4. 5 P

Marrero, J. Potting media for Honduras pine. United States Forest Service Research Note ITF-5. 5 p.

Marrero, J. Survival and growth of bagged and barerooted Honduras pine, cadam, and primavera. United States Forest Service Research Note ITF-3. 5 p.

Wadsworth, F.H. Los bosques de Puerto Rico. Revista del Café 12:13-20.

Wadsworth, F.H. Tropical forest regeneration practices. Proceedings, Duke University Forestry Symposium Bulletin 19:1-29.

1966

Barres, H. La recherche sylvicole a Puerto Rico [Silvicultural research in Puerto Rico]. Journal Forestiere Suisse 2:127-134.

Briscoe, C.B. Minimizing experimental error in thinning research. Paper 6CFM/E/C.T.III/40 *in* Proceedings of the Sixth World Forestry Congress. Madrid, Spain.

Briscoe, C.B. Weather in the Luquillo Mountains. United States Forest Service Research Paper ITF-3. 258 p.

Briscoe, C.B. and R.W. Nobles. Effects of pruning teak. United States Forest Service Research Note ITF-11. 5 p.

*Chudnoff, M., E.D. Maldonado, and E. Goytía. Solar drying of tropical hardwoods. United States Forest Service Research Paper ITF-2. 26 p.

Hadley, H.H. and C.B. Briscoe. Herbicides for forest plantations. United States Forest Service Research Note ITF-6. 6 p.

*Nobles, R.W. and C.B. Briscoe. Height growth of mahogany seedlings. United States Forest Service Research Note ITF-10. 3 p.

Nobles, R.W. and C.B. Briscoe. Killing unwanted West Indies mahogany trees by peeling and frilling. United States Forest Service Research Note ITF-8. 3 p.

Nobles, R.W. and C.B. Briscoe. Mowing understory vegetation in a young teak plantation. United States Forest Service Research Note ITF-9. 2 p.

Nobles, R.W. and C.B. Briscoe. Root pruning of mahogany nursery stock. United States Forest Service Research Note ITF-7. 4 p.

Wadsworth, F.H. Forest resources of the tropical world. Paper G/C.T. VI/9 *in* Proceedings of the Sixth World Forestry Congress. Madrid, Spain. [With Spanish translation].

Wadsworth, F.H. La orientación de las investigaciones de silvicultura para Latinoamérica. Turrialba 16(4):390-395.

Wadsworth, F.H. Problemas dasonómicos de los trópicos húmedos de América. *In* Report of Reunión Internacional Sobre Problemas de la Agricultura en los Trópicos Húmedos de América Latina. Lima, Perú. 4 p.

1967

Chudnoff, M. Post incising machine design. Forest Products Journal 17:33-34.

Chudnoff, M.R., R.S. Boone, and E. Goytía. Preservative treatments and service life of fence posts in Puerto Rico. United States Forest Service Research Paper ITF-4. 33 p.

Chudnoff, M. and E. Goytía. Dimensional stabilization of tropical hardwoods with polyethylene glycol. Turrialba 17:309-314.

*Chudnoff, M. and E. Goytía. The effect of incising on drying, treatability, and bending strength of posts. United States Forest Service Research Paper ITF-5. 20 p.

Chudnoff, M. and E. Goytía. Spindle carving of tropical hardwoods. Turrialba 17(4):430-435.

Little, E.L., F.H. Wadsworth, and J. Marrero. Arboles comunes de Puerto Rico y las Islas Vírgenes. Editorial UPR, Río Piedras, Puerto Rico. 806 p. [Available through the authors, $16].

*Muñoz, J.E. and L.W. Hill. The use of herbicides for site preparation and their effects on tree survival. United States Forest Service Research Note ITF-12. 6 p.

Wadsworth, F.H. A design for planned use of our rural land resources. Pages 55-75 *in* Ponencia y Comentarios, Conferencia Sobre la Conservacion de Recursos Naturales. Institute of Urban Law, University of Puerto Rico School of Law, Río Piedras, Puerto Rico.

1968

Maldonado, E.D. and R.S. Boone. Shaping and planing characteristics of plantation-grown mahogany and teak. United States Forest Service Research Paper ITF-7. 22 p.

Wadsworth, F.H. Conservation of the natural features of our estuarine zones. Pages 78-81 *in* Clean Water for the Nation's Estuaries. Proceedings of Puerto Rico Meeting, April 22, 1968. Federal Water Pollution Control Administration, Atlanta, Georgia, USA.

Wadsworth, F.H. Public forestry research in Latin America, its status and needs. United States Forest Service Research Paper ITF-6. [Translated into Spanish and published as Departamento de Agricultura de los Estados Unidos Boletín de Investigación ITF-6. 19 p. It was republished in Spanish as FAO Boletín Forestal y de Industrias Forestales para América Latina (Santiago de Chile, Chile) No. 57, and in Boletín Instituto Forestal Latinoamericano de Investigación y Capacitación (Mérida, Venezuela) 29 (in 1969).

1969

Boone, R.S., M. Chudnoff, and E. Goytía. Chemical control of bostrichidae during air drying of fence posts. United States Forest Service Research Note ITF-8. 8 p.

Briscoe, C.B. and R.W. Nobles. Efectos de la poda sobre la teca (*Tectona grandis*). [Spanish translation of United States Forest Service Research Note ITF-11]. Boletín Instituto Forestal Latino-Americano de Investigación y Capacitación (Mérida, Venezuela) 29:29-34.

Chudnoff, M. Research needs. Pages 10-1 - 10-10 *in* Proceedings of the Conference on Tropical Hardwoods. State University of New York, College of Forestry at Syracuse University, Syracuse, New York, USA.

Chudnoff, M., R.S. Boone, and E. Goytía. Preservative treatments and service life of fence posts in Puerto Rico (1969 Progress Report). United States Forest Service Research Paper ITF-10. 30 p.

Chudnoff, M. and R. Wawriw. Effectiveness of groundline treatments of creosoted pine poles under tropical exposure ... an interim report. Turrialba 19(1):117-125.

Geary, T.H. Adaptability of Mexican and Central American provenances of *Swietenia* in Puerto Rico and St. Croix. FAO-FTB-69-2/19. Food and Agriculture Organization of the United Nations, Rome, Italy.

Little, E.L., Jr. Trees of Jost Van Dyke (British Virgin Islands). Forest Service Research Paper ITF-9. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Río Piedras, Puerto Rico.

Monteith, D.B. and R. Ybarra-Coronado. Survival of bare-rooted Honduras pine in Puerto Rico. Turrialba 19:291-292.

Wadsworth, F.H. Posibilidades futuras de los bosques del Paraguay. Ministerio de Agricultura y Ganadería, Naciones Unidas, Programa para el Desarrollo, Asunción, Paraguay. 36 p.

Wadsworth, F.H. Investigaciones públicas de dasonomía en Latinoamérica, su estado y sus necesidades. Boletín Instituto Forestal Latino-Americano de Investigación y Capacitación (Mérida, Venezuela) 29:3-18.

Wadsworth, F.H. Techniques for surveys and the ecological exploitation of tropical forests. Anais da Academia Brasileira de Ciencias (Brazil) 41 (Suppl.):101-109.

Whitmore, J.L. and C.S. Hartshorn. Literature review of common tropical trees. Tropical Forestry Series Contribution 8, Institute of Forest Products, College of Forest Resources, University of Washington, Seattle, Washington, USA. 113 p.

1970

Boone, R.S. and M. Chudnoff. Variations in wood density of the mahoganies of Mexico and Central America. Turrialba 20(3):369-371.

Briscoe, C.B. and F.H. Wadsworth. Stand structure and yield in the tabonuco forest of Puerto Rico. Pages B79-B89 *in* T.H. Odum and R.F. Pigeon, editors. A tropical rain forest: a study of irradiation and ecology at El Verde, Puerto Rico. United States Atomic Energy Commission, Oak Ridge, Tennessee, USA.

Chudnoff, M. Water assay for treatability of wood. Forest Products Journal 29(9):103-107.

Chudnoff, M. and R. Wawriw. Effectiveness of groundline treatments of creosoted pine poles under tropical exposure. Second interim report. Turrialba 20(3):367-368.

Little, E.L., Jr. Relationships of trees of the Luquillo Experimental Forest. Pages B47-B56 *in* H.T. Odum and R.F. Pigeon, editors. A tropical rain forest: a study of irradiation and ecology at El Verde, Puerto Rico. United States Atomic Energy Commission, Oak Ridge, Tennessee, USA.

Venator, R. [C.R.] and F.K.S. Koo. Inherent and radiation-induced cytological abnormalities in *Palicourea riparia* Benth. Pages G21-G38 *in* H.T. Odum and R.F. Pigeon, editors. A tropical rain forest: a study of irradiation and ecology at El Verde, Puerto Rico. United States Atomic Energy Commission, Oak Ridge, Tennessee, USA.

Wadsworth, F.H. Review of past research in the Luquillo Mountains of Puerto Rico. Pages B33-B46 *in* H.T. Odum and R.F. Pigeon, editors. A tropical rain forest: a study of irradiation and ecology at El Verde, Puerto Rico. United States Atomic Energy Commission, Oak Ridge, Tennessee, USA.

1971

*Briscoe, C.B. and R. Ybarra-Coronado. Increasing growth of established teak. United States Forest Service Research Note ITF-13. 7 p.

Chudnoff, M. Tissue regeneration of debarked *Eucalyptus*. Forest Science 17(3):300-305.

Chudnoff, M. and E. Goytía. Treatability of Puerto Rican woods. United States Forest Service Research Paper ITF-11. 8 p.

Crown, T.R. Estimation of biomass in an even-aged stand--regression and "mean tree" techniques. Pages 35-48 *in* H.E. Young, editor. Forest biomass studies. Miscellaneous Publication 132. Life Sciences and Agricultural Experiment Station, University of Maine, USA.

Geary, T.F. Silvicultural research programme for Jamaica. UNDP/FAO Project Paper, Jamaica 5. Food and Agriculture Organization of the United Nations, Rome, Italy.

Geary, T.F., G. Avila Cortés, and H.H. Hadley. Germination and growth of *Pinus caribaea* directly sown into containers as influenced by shade, phosphate, and captan. Turrialba 21:336-342.

Wadsworth, F.H. Environmental criteria for development planning--agriculture and land use. An Environmental Newsletter [The Caribbean Conservation Association] 2(3):7-17.

Wadsworth, F.H. Forestry potential and its development in Central America. Pages 171-189 *in* Proceedings of the Conservación del Medio Ambiente Físico y el Desarrollo. Primer Seminario Centroamericano sobre el Medio Ambiente Físico y el Desarrollo, ICAITI/National Academy of Science. Antigua, Guatemala.

Wadsworth, F.H. Import substitution: forestry. Industrial Puerto Rico 8(4):22-25, 54-55.

Wadsworth, F.H. La perspectiva de los bosques en el ambiente puertorriqueño. Simposio sobre Control de la Calidad Ambiental, Servicio de Extensión Agrícola, Universidad de Puerto Rico, abril 1971. Revista del Café 26(8):39-40 y 26(10):40-42.

Whitmore, J.L. *Cedrela* provenance trial in Puerto Rico and St. Croix: nursery phase assessment. Turrialba 21:343-349.

1972

Boone, R.S. and M. Chudnoff. Compression wood formation and other characteristics of plantation-grown *Pinus caribaea*. United States Forest Service Research Paper ITF-13. 16 p.

*Chudnoff, M. and E. Goytía. Preservative treatments and service life of fence posts in Puerto Rico (1972 Progress Report). United States Forest Service Research Paper ITF-12. 28 p.

*Chudnoff, M. Void volume wood: an any-tree-whole tree use concept. Forest Products Journal 22(6):49-53.

Geary, T.F. and C.B. Briscoe. Tree species for plantations in the granitic uplands of Puerto Rico. United States Forest Service Research Paper ITF-14. 8 p.

Geary, T.F., R.W. Nobles, and C.B. Briscoe. Hybrid mahogany recommended for planting in the Virgin Islands. United States Forest Service Research Paper ITF-15. 4 p.

Geary, T.F. and J.A. Zambrana. Comparative adaptability of conifers in Puerto Rico. Pages 226-234 *in* J. Burley and D.G. Nikles, editors. Selection and breeding to improve some tropical conifers. Proceedings of the Symposium of IUFRO Working Group on Breeding Tropical and Subtropical Species, Gainesville, Florida. Volume I. Commonwealth Forestry Institute, Oxford University, Oxford, England and Department of Forestry, Queensland, Australia.

Geary, T.F. and J.A. Zambrana. Must Honduras pine be weeded frequently in Puerto Rico? United States Forest Service Research Paper ITF-16. 16 p.

*Venator, C.R. Effect of gibberelic acid on germination of low-vigor Honduras pine seeds. Forest Science 18(4):331.

Venator, C.R. and J.A. Zambrana. Extraction and germination of kadam seed. United States Forest Service Research Note ITF-14. 2 p.

Wadsworth, F.H. An evaluation of the mangroves west of Jobos Bay, Puerto Rico. [The Natural History Society of Puerto Rico]. Pages 165-189, XII Appendix C *in* Aguirre Power Complex Environmental Report. Puerto Rico Water Resources Authority, San Juan, Puerto Rico.

Wadsworth, F.H. Status of forestry research in Latin America. Paper 7CF M/C:V/4G *in* Proceedings of the Seventh World Forestry Congress, Argentina.

Weaver, P.L. Cloud moisture interception in the Luquillo Mountains of Puerto Rico. Caribbean Journal of Science 12(3-4):129-144.

Weaver, P.L. The dwarf forest of Pico del Este and the Luquillo Mountains. Revista/Review Interamericana 2(2): 174-186.

*Whitmore, J.L. *Pinus merkusii* unsuitable for plantations in Puerto Rico. Turrialba 22(3):351-353.

Whitmore, J.L. and T.F. Geary. *Pinus merkusii* provenance trial in Puerto Rico. Pages 161-171 *in* J. Burley and D.G. Nikles, editors. Selection and Breeding to Improve Some Tropical Conifers. Proceedings of the Symposium of IUFRO Working Group on Breeding Tropical and Subtropical Species, Gainesville, Florida. Volume I. Commonwealth Forestry Institute, Oxford University, Oxford, England and Department of Forestry, Queensland, Australia.

1973

*Chudnoff, M. and T.F. Geary. On the heritability of wood density in *Swietenia macrophylla*. Turrialba 23(3):359-362.

Chudnoff, M. and T.F. Geary. Terminal shoot elongation and cambial growth rhythms in *Pinus caribaea*. Commomwealth Forestry Review 52(4)No. 154:317-324.

Chudnoff, M., L.R. Gjovik, and R. Wawriw. Effectiveness of groundline treatments of creosoted pine poles under tropical exposure. Forest Products Journal 23(9):80-84.

Ewel, J.J. and J.L. Whitmore. Ecological life zones of Puerto Rico and the U.S. Virgin Islands. United States Forest Service Research Paper ITF-18. 79 p. + map.

Ewel, J.J. and J.L. Whitmore. Las zonas de vida de Puerto Rico y las Islas Vírgenes Americanas: una sinopsis. Departamento de Agricultura de los Estados Unidos Boletín de Investigación ITF-18A. 9 p. + map.

Gara, R.I., G.G. Allan, R.M. Wilkins, and J.L. Whitmore. Flight and host selection behavior of the mahogany shoot borer, *Hypsipyla grandella* Zeller. Zeitschrift fur angewandte Entomologie 72(3):259-266.

Geary, T.F., H. Barres, and R. Ybarra-Coronado. Seed source variation in Puerto Rico and Virgin Islands grown mahoganies. United States Forest Service Research Paper ITF-17. 24 p.

Geary, T.F. and N.F. de Barros. Seed crop environment may influence progeny tests. Commonwealth Forestry Review 52:160-162.

Geary, T.F. and F.R. Macia Sanabria. Density of the juvenile wood of *Pinus caribaea* var. *hondurensis* grown in subtropical moist and wet life zones of Puerto Rico. Turrialba 23(4):477-480.

Venator, C.R. An abnormal short primary needle form of *Pinus caribaea* var. *hondurensis*. Pages 322-326 *in* J. Burley and D.G. Nikles, editors. Tropical Provenance and Progeny Research and International Cooperation. Proceedings of the Joint Meeting of IUFRO Working Parties S2.02.8 and S2.03.1, Nairobi, Kenya, October 1973. Oxford University, Commonwealth Forestry Institute, Oxford, England.

Venator, C.R. International provenance trials of *Pinus caribaea* and *P. oocarpa* in Puerto Rico. Pages 26-28; 95-96 *in* J. Burley and D.G. Nikles, editors. Tropical Provenance and Progeny Research and International Cooperation. Proceedings of the Joint Meeting of IUFRO Working Parties S2.02.8 and S2.03.1, Nairobi, Kenya, October 1973. Oxford University, Commonwealth Forestry Institute, Oxford, England.

Venator, C.R. The relationship between seedling height and date of germination in *Pinus caribaea* var. *hondurensis*. Turrialba 23(4):473-474.

Venator, C.R. and F. Macia Sanabria. A problem of empty seed in *Pinus caribaea* in Puerto Rico. Turrialba 23:236-238.

Wadsworth, F.H. The historical resources of Mona Island. Pages N1-N37, Volume II, Appendix N *in* Mona and Monito Islands: An assessment of Their Natural and Historical Resources. Environmental Quality Board, San Juan, Puerto Rico.

Wadsworth, F.H. El manejo de las reservas forestales chilenas de Malleco y Malalcahuello. FO:SF/CHI 26 Informe Técnico 2, Fortalecimiento del Programa Forestal Nacional, Chile, Programa de las Naciones Unidas para el Desarrollo. Food and Agriculture Organization, Rome, Italy.

Whitmore, J.L. International provenance trials of: *Pinus kesiya* (including *P. merkusii* also); *P. merkusii, Cedrela,* and *Eucalyptus* in Puerto Rico. Pages 198-199; 223-224; 238-239; 297-299 *in* J. Burley and D.G. Nikles, editors. Tropical Provenance and Progeny Research and International Cooperation. Proceedings of a Joint Meeting of IUFRO Working Parties S2.002.8 and S2.03.1, Nairobi, Kenya, October 1973. Oxford University, Commonwealth Forestry Institute, Oxford, England.

1974

Liegel, L.H. and G.A. del Toro. An intensive natural resources inventory aids land use planning and resources management in Puerto Rico. Pages 57-65 *in* Proceedings of the American Society of Photogrammetry 1974 Fall Meeting, Washington, DC, USA.

Liegel, L.H. and G.A. del Toro. Merits of conventional aerial photography in an intensive natural resources inventory in Puerto Rico. Pages 178-191 *in* Proceedings of the American Society of Photogrammetry 40th Annual Meeting, St. Louis, Missouri, USA.

Little, E.L., Jr., R.O. Woodbury, and F.H. Wadsworth. Trees of Puerto Rico and the Virgin Islands. Second Volume. United States Department of Agriculture, Agriculture Handbook 449, 1024 p. [Available through United States Government Printing Office, Washington, DC, USA, $13.45].

Venator, C.R. Hypocotyl length in *Pinus caribaea* seedlings: a quantitative genetic variation parameter. Silvae Genetica 23:130-132.

Venator, C.R. Low cone yields of Honduras pine in Puerto Rico not due to pollen abortion. Turrialba 24:107-108.

Venator, C.R. Vegetative regeneration of *Pinus oocarpa* Schiede seedlings from storage organs. *In* Paper presented to Physiology Working Group at Third North American Forest Biology Workshop, Fort Collins, Colorado, USA.

Venator, C.R., C.D. Howes, and L. Telek. Chlorophyll: carotenoid ratio as a parameter to predict plant adaptability. Genetics 77 (Suppl. 1):S68. (Abstract only).

Wadsworth, F.H. Management of mountain habitat on a densely populated tropical island. *In* Session VII/Pap. 19:212-218. Proceedings of the Second World Conference on National Parks, International Union for Conservation of Nature and Natural Resources, Morges, Switzerland. [Also published in Spanish edition].

Wadsworth, F.H. Prospects for hardwood from the tropics. *In* Proceedings of the Hardwood Symposium of the Hardwood Research Council, May 2-4, 1974, North Carolina, USA.

Whitmore, J.L. *Cedrela* provenance trial in Puerto Rico and St. Croix: three years after outplanting. *In* Paper presented at I Congresso Brasileiro de Florestas Tropicais, Vicosa, Brazil. [Printed as Research Note ITF-16, 1978].

Whitmore, J.L. and S. Medina-Gaud. White peachscale attack on toon in Puerto Rico. Journal of Agriculture of the University of Puerto Rico 58(2):276-278.

1975

Gara, R.I., G.G. Allan, R.M. Wilkins, and J.L. Whitmore. Comportamiento del barrenador de las Meliaceae *Hypsipyla grandella* Zeller (Lepidoptera Pryalidae) durante su vuelo y selección del arbol huesped. Boletín No. 49. Instituto Forestal Latinoamericano de Investigación y Capacitación, Mérida, Venezuela. 49 p.

Venator, C.R. Directory of manufacturers and distributors of containers suitable for growing forest tree seedlings. United States Forest Service Research Note ITF-15. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 8 p.

Venator C.R. and J.E. Muñoz. Containerized tree production in the tropics. Pages 334-335 *in* R.W. Tinus, W.I. Stein, W.E. Balmer, editors. Proceedings of the North American Containerized Forest Tree Seedling Symposium. Great Plains Agricultural Council Publication 68:334-335.

*Venator, C.R. and J.A. Zambrana. Extraction and germination of kadam seed. United States Forest Service Research Note ITF-14A (revised).

Wadsworth, F.H. Natural forests in the development of the humid American tropics. Pages 129-138 *in* Proceedings of the International Union for the Conservation of Nature and Natural Resources and the International Meeting on the Use of Ecological Guidelines for Development in the American Humid Tropics, February 1974. International Union for the Conservation of Nature and Natural Resources, Morges, Switzerland.

Wadsworth, F.H. Los bosques naturales en el desarrollo de las regiones tropicales húmedas americanas. Ecología 2000 4:21-26.

Weaver, P.L. Transpiration rates in the elfin forest of the Luquillo Mountains of Puerto Rico. Caribbean Journal of Science 15(1-2):21-30.

Whitmore, J.L. and F. Macia S. *Eucalyptus* provenances tested in Puerto Rico: two years after outplanting. Forest Science 21(4):410-412.

1976

Gara, R.I., G.G. Allan, R.M. Wilkins, and J.L. Whitmore. Comportamiento en vuelo y selección de hospedero del barrenador de las Meliaceas, *Hypsipyla grandella* Zeller (Lepid., Pyralidae). Pages 116-121 *in* J.L. Whitmore, editor. Studies on the shootborer *Hypsipyla grandella* (Zeller) Lep., Pyralidae. Volume II. IICA Miscellaneous Publication No. 101. Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica. [Translated from paper originally in Zeitschrift fur angewandte Entomologie 72(3):259-266. (1973)].

Little, E.L., Jr. and R.O. Woodbury. Trees of the Caribbean National Forest, Puerto Rico. United States Forest Service Research Paper ITF-20. 27 p.

*Little, E.L., Jr., R.O. Woodbury, and F.H. Wadsworth. Flora of Virgin Gorda (British Virgin Islands). United States Forest Service Research Paper ITF-21. 36 p.

Mosquera Moreno, M. and J.L. Whitmore. Bibliografia sobre *Hypsipyla.* Pages 130-139 *in* J.L. Whitmore, editor. Studies on the shootborer *Hypsipyla grandella* (Zeller) Lep., Pyralidae. Volume II. IICA Miscellaneous Publication No. 101. Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica.

Otorola, A., J.L. Whitmore, and R. Salazar. Analisis de 12 plantaciones de *Toona ciliata* var. *australis* en Turrialba, Costa Rica. Turrialba 26(1):80-85.

Sánchez, J.C., E.H. Holsten, and J.L. Whitmore. Comportamiento de 5 especies de Meliaceae en Florencia Sur, Turrialba. Pages 97-103 *in* J.L. Whitmore, editor. Studies on the shootborer *Hypsipyla grandella* (Zeller) Lep., Pyralidae. Volume III. CATIE Miscellaneous Publication No. 1. (IICA Miscellaneous Publication No. 101). Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica.

United States Department of Agriculture, Forest Service, Southern Region. Instituto de Dasonomía: Institute of Tropical Forestry, United States Forest Service. [Illustrated brochure in English and Spanish describing the work of the Institute]. Río Piedras, Puerto Rico. 20 p.

Venator, C.R. Hypocotyl color: evidence for polymorphism in *Pinus caribaea.* Turrialba 26(3):265-267.

*Venator, C.R. A mutant *Pinus caribaea* var. *hondurensis* seedling incapable of developing normal secondary needles. Turrialba 26(1):98-99.

*Venator, C.R. Natural selection for drought resistance in *Pinus caribaea* Morelet. Turrialba 26(4):381-387.

Wadsworth, F.H. A forestry program for the Instituto Superior de Agricultura, Santiago de los Caballeros, Dominican Republic. Report on consultancy, March 14-18, 1976, through the United States Agency for International Development. United States Agency for International Development, Washington, DC, USA.

Wadsworth, F.H. Book review of: Goodland, R.J.A. and H.S. Irwin. 1975 Amazon jungle: green hell or red desert. Elsevier Scientific Publishing Company, New York, New York, USA. 155 p.

Wadsworth, F.H. Reseña histórica de la Isla de Mona. Revista/Review Interamericana 6(4):587-621.

Wadsworth, F.H. Mejoramiento de las bases técnicas para la silvicultura en Chile. Informe Técnico No. 11. Proyecto/PNUD/FAO,CHI/66/526. Corporación Nacional Forestal, Santiago de Chile, Chile. 32 p.

Wadsworth, F.H. Public forestry research in Latin America. *In* Paper presented at Twelfth Session of the Food and Agriculture Organization of the United Nations, Latin American Forestry Commission, Third Session of the Committee on Forestry Research, Havana, Cuba. 11 p.

Weaver, P.L. Ecological aspects and value of dwarf forest vegetation to Puerto Rico. Voluntary paper submitted to the Technical Conference on Tropical Moist Forests, originally due to be held September 22 - October 3, 1975, and eventually cancelled. Food and Agriculture Organization of the United Nations, Rome, Italy. [Unpublished; however, reproductions of this paper may be obtained from FAO Library and Documentation Division (attention: DIS/Library)].

Weaver, P.L., L.O. Nieves, and T.R. Crow. Roosevelt Roads: Survey of mangrove forest and the Río Daguao Watershed. Report submitted to the United States Navy, Roosevelt Roads Naval Station, Ceiba, Puerto Rico.

Whitmore, J.L., editor. Studies on the shootborer *Hypsipyla grandella* (Zeller) Lep., Pyralidae. Volume II. IICA Miscellaneous Publication No. 101. Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica. 139 p.

Whitmore, J.L., editor. Studies on the shootborer *Hypsipyla grandella* (Zeller) Lep., Pyralidae. Volume III. CATIE Miscellaneous Publication No. 1 (IICA Miscellaneous Publication No. 101). Centro de Investigación y Enseñanza, Turrialba, Costa Rica. 116 p.

Whitmore, J.L. and A. Otarola. *Acrocarpus fraxinifolius* Wight, especie de rápido crecimiento inicial, buena forma y madera de usos múltiples. Turrialba 26(2):201-204.

*Woodbury, R.O. and E.L. Little, Jr. Flora of Buck Island Reef National Monument (U.S. Virgin Islands). United States Forest Service Research Paper ITF-19. 27 p.

1977

Byer, M.D. and P.L. Weaver. Early secondary succession in an elfin woodland in the Luquillo Mountains of Puerto Rico. Biotropica 9(1):35-47.

*Crow, T.R. and P.L. Weaver. Tree growth in a moist tropical forest of Puerto Rico. United States Forest Service Research Paper ITF-22. 17 p.

Schubert, T.H. Book review of: Whitmore, T.C. 1975. Tropical rain forests of the Far East. Clarendon Press, Oxford, England. 282 p. *In* Forest Science 23(1):80.

*Venator, C.R. Formation of root storage organs and sprouts in *Pinus oocarpa* seedlings. Turrialba 27(1):41-45.

*Venator, C.R., C.D. Howes, and L. Telek. Chlorophyll and carotenoid contents of *Pinus caribaea* seedlings and inferences for adaptability. Turrialba 27(2):169-173.

*Venator, C.R., J.E. Munoz, and N.F. Barros. Root immersion in water; a promising method for successful bare-root planting of Honduras pine. Turrialba 27(3):287-291.

*Venator, C.R. and A. Rodríguez. Using styroblock containers to grow *Pinus caribaea* var. *hondurensis* Barr. & Golf. nursery seedlings. Turrialba 27(4):393-396.

Wadsworth, F.H. and T.H. Schubert. Especies adaptables a suelos forestales disponibles en Puerto Rico. Revista/Review Interamericana 7(2):320-332.

Whitmore, J.L. Classification of ecosystems in land management planning. Pages 299-303 *in* Proceedings of the Society of American Foresters 1977 Annual Meeting. Albuquerque, New Mexico, USA.

Whitmore, J.L. Fortalecimiento del programa forestal: Paraguay. Pautas para labores de investigación forestal. FAO-PNUD Informe Técnico No. 9. FO:DP/PAR/72/991. Food and Agriculture Organization of the United Nations, Rome, Italy. 40 p.

Whitmore, J.L. and G. Hinojosa. Mahogany (*Swietenia*) hybrids. United States Forest Service Research Paper ITF-23. 8 p.

Zambrana, J.A. and T.H. Schubert. Black olive or Gregre: an ornamental and shade tree for confined areas and adverse conditions. Southeastern Area, United States Forest Service Urban Forestry Bulletin, Caribbean Area. 2 p.

1978

Crow, T.R. Common regressions to estimate tree biomass in tropical stands. Forest Science 24(1):110-114.

Forest Products Laboratory - Forest Service - U.S. Department of Agriculture. Proceedings of Conference on Improved Utilization of Tropical Forests. Conference sponsored by the Forest Products Laboratory, Forest Service, United States Department of Agriculture and the Agency for International Development, United States Department of State, May 21-26, 1978, Madison, Wisconsin. Forest Products Laboratory, Forest Service, United States Department of Agriculture, Madison, Wisconsin, USA. 569 p.

Kandya, A.K., C.R. Venator, and E.F. Brunig. Seed and seedling characteristics in *Pinus caribaea* Mor. as geographical variation parameters: a view point. Tropical Ecology 19(1):65-69.

Lugo, A.E. Stress and ecosystems. Pages 62-101 *in* J.H. Thorp and J.W. Gibbons, editors. Energy and environmental stress in aquatic systems. DOE Symposium Series (CONF-771114). National Technical Information Service, Springfield, Virginia, USA.

Lugo, A.E., J.A. González-Liboy, B. Cintrón, and K. Dugger. Structure, productivity, and transpiration of a subtropical dry forest in Puerto Rico. Biotropica 10(4):278-291.

*Schubert, T.H. and J. Zambrana. Honduras or big-leaf mahogany. Southeastern Area, United States Forest Service Urban Forestry Bulletin, Caribbean Area. 2 p.

*Schubert, T.H. and J. Zambrana. West Indies or small-leaf mahogany. Southeastern Area, United States Forest Service Urban Forestry Bulletin, Caribbean Area. 2 p.

Snyder, N.F.R. Puerto Rican parrots and nest-site scarcity. Pages 47-53 *in* S.A. Temple, editor. Endangered birds: management techniques for preserving threatened species. University of Wisconsin Press, Madison, Wisconsin, USA.

Wadsworth, F.H. Aspectos ambientales del pino australiano [Wrong caption: should have read "pino del Caribe"]. Revista del Colegio de Agrónomos de Puerto Rico. April-June:6-7.

Wadsworth, F.H. Deforestation, death to the Panama Canal. Pages 22-24 *in* Proceedings of the United States Strategy Conference on Tropical Deforestation. United States Department of State, Washington, DC, USA.

Wadsworth, F.H. Bosques maderables. Pages 325-340 *in* Conceptos, plan y programa para una agricultura moderna en Puerto Rico. Puerto Rico Department of Agriculture, San Juan, Puerto Rico.

Wadsworth, F.H. Manejo de florestas tropicais naturais anais do seminario sobre panejamento do desenvolvimento florestal e do uso de terra. Instituto Brasileiro de Desenvolvimento Florestal II:203-206.

Wadsworth, F.H. Book review of: Cozzo, Domingo. 1976. Tecnología de la Forestación en Argentina y América Latina. Hemisferio Sur, Buenos Aires, 610 p. *In* Journal of Forestry 76:233.

Weaver, P.L. and L. Nieves. Periodic annual DBH increment in a subtropical moist forest dominated by *Syzygium jambos* (L) Alston. Turrialba 28(3):253-256.

*Whitmore, J.L. Bibliography on *Eucalyptus deglupta* Bl. United States Forest Service Research Note ITF-17. 18 p.

*Whitmore, J.L. *Cedrela* provenance trial in Puerto Rico and St. Croix: establishment phase. United States Forest Service Research Note ITF-16. 11 p.

Whitmore, J.L. Forestry potential. Pages 1-7, Chapter VIII *in* Vieques - 1972 survey of the natural resources. Commonwealth of Puerto Rico. Office of the Governor, Environmental Quality Board, San Juan, Puerto Rico.

Whitmore, J.L. Book review of: Burley, J. and P.J. Wood. 1976. A manual on species and provenance research with particular reference to the tropics. Department of Forestry, Commonwealth forestry Institute, University of Oxford, Oxford, England. Tropical Forestry Paper No. 10. 226 p. *In* Forest Science 24(2):192.

1979

Crow, T.R. and D.F. Grigal. A numerical analysis of arborescent communities in the rain forest of the Luquillo Mountains, Puerto Rico. Vegetatio 40(3):135-146.

Nieves, L. Ecological life history of *Didymopanax morototoni*. M.S. Thesis, University of Puerto Rico.

Schubert, T.H. Trees for urban use in Puerto Rico and the Virgin Islands. United States Forest Service General Technical Report S0-27. 90 p.

Wadsworth, F.H. Review of: Eckholm, Eric. 1976. Planting for the future: forestry for human needs. Worldwatch Institute Worldwatch Paper 26. 64 p. American Forester 85(7):60-61.

Wadsworth, F.H. and T.H. Schubert. La adaptabilidad de las especies de árboles a suelos forestales disponibles en Puerto Rico. Pages 58-69 *in* Ponencias presentadas en el Simposio Sobre la Siembra de Pino Hondureño y Otras Especies de Arboles en Puerto Rico, 22-23 de febrero de 1977. Auspiciado conjuntamente por la Asociación Médica y el Concilio Evangélico de Puerto Rico y el Servicio Forestal Federal. United States Forest Service Publicación Técnica SA-TP8, United States Department of Agriculture, Forest Service, Southeastern Area, State and Private Forestry, Atlanta, Georgia.

Weaver, P.L. Agri-silviculture in tropical America. Unasylva 31(26):2-12.

Weaver, P.L. Tree growth in several tropical forests of Puerto Rico. United States Forest Service Research Paper S0-152. 15 p.

Weaver, P.L. and D.J. Pool. Correlation of crown features to growth rates in natural forests of Puerto Rico. Turrialba 29(1):53-58.

1980

Arendt, W.J. Una introduccion a la ecología del Zorzal Pardo (*Margarops fuscatus*) en la Sierra de Luquillo, Puerto Rico (An introduction to the ecology of the Pearly-eyed Thrasher [*Margarops fuscatus*] in the Luquillo Mountains, Puerto Rico). Pages 69-80 *in* Memorias del Segundo Coloquio sobre la Fauna de Puerto Rico, Universidad de Puerto Rico, Colegio Universitario de Humacao, Departamento de Biología, enero 1980, Humacao, Puerto Rico.

Arendt, W.J., T.A. Vargas Mora, and J.W. Wiley. White-crowned pigeon: status rangewide and in the Dominican Republic. *In* Proceedings of the Annual Conference of the S.E. Association of Fish and Wildlife Agencies 33:111-122.

Brown, S. and A.E. Lugo. Preliminary estimate of the storage of organic carbon on tropical forest ecosystems. Pages 118-139 *in* S. Brown, A.E. Lugo, and B. Liegel, editors. The role of tropical forests on the world carbon cycle. CONF-800350 UC-11 United States Department of Energy, Washington, DC, USA. [Available from: National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia. 22161, USA].

Brown, S., A.E. Lugo, and B. Liegel, editors. The role of tropical forests on the world carbon cycle. CONF-800350 UC-11 United States Department of Energy, Washington, DC, USA. [Available from: National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia. 22161, USA].

Cintrón, G., C. Goenaga, and A.E. Lugo. Observaciones sobre el desarrollo del manglar en costas áridas. [Study of mangrove development in dry coastal areas]. Pages 18-32 *in* Proceedings of the Estudio Científico e Impacto Humano en el Ecosistema de Manglares. Oficina Regional de Ciencia y Tecnologia de la Unesco para América Latina y el Caribe, Montevideo, Uruguay. [ISBN 92-3-001810-4].

Crow, T.R. A rainforest chronicle: a 30-year record of change in structure and composition at El Verde, Puerto Rico. Biotropica 12(1):42-55.

DiTomaso, J.M. Vegetation analysis of the Río Abajo forest and potential Puerto Rican parrot food availability (a study for future relocation of *Amazona vittata*). United States Department of Agriculture, Forest Service, Caribbean National Forest, Río Piedras, Puerto Rico. 17 p.

Figueroa, J.C. and J.L. Whitmore. Three species of *Eucalyptus* provenances in Puerto Rico: five years after outplanting. Southern Journal of Applied Forestry 4(4):169-174.

Little, E.L., Jr. and R.O. Woodbury. Rare and endemic trees of Puerto Rico and the Virgin Islands. Conservation Research Report No. 27. United States Department of Agriculture, Forest Service, Washington, DC, USA. 26 p.

Lugo, A.E. Are tropical forests sources or sinks of carbon? Pages 1-18 *in* S. Brown, A.E. Lugo, and B. Liegel, editors. The Role of Tropical Forests on the World Carbon Cycle. CONF-800350 UC-11 United States Department of Energy, Washington, DC, USA. [Available from: National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia. 22161, USA].

Lugo, A.E. La ecología, los sistemas tropicales y el hombre. [Ecology, tropical systems and man]. Boletín de la Sociedad Venezolana de Ciencias Naturales 34(137):7-41.

Lugo, A.E. Mangrove ecosystems: successional or steady state? Biotropica 12 Suppl. 2:65-72.

Lugo, A.E. and S. Brown. Ecological issues associated with the interpretation of atmospheric CO_2 data. Pages 30-43 *in* S. Brown, A.E. Lugo, and B. Liegel, editors. The Role of Tropical Forests on the World Carbon Cycle. CONF-800350 UC-11 United States Department of Energy, Washington, DC, USA. [Available from: National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia. 22161, USA].

Lugo, A.E. and S. Brown. Tropical forest ecosystems: sources or sinks of atmospheric carbon? Unasylva 32(129):8-13.

Lugo, A.E. and S. Brown. Tropical forests as a Puerto Rican energy source. Part V, 16 p. *in* Proceedings of Fuels and Feedstocks from Tropical Biomass, held November 25, 1980 in San Juan, Puerto Rico. CEER-B-104. Biomass Division, UPR Center for Energy and Environment Research, Río Piedras, Puerto Rico.

Lugo, A.E., G. Cintrón, and C. Goenaga. El ecosistema del manglar bajo tensión. [The mangrove ecosystem under stress]. Pages 261-285 *in* Proceedings of the Estudio Científico e Impacto Humano en el Ecosistema de Manglares. Oficina Regional de Ciencia y Tecnología de la UNESCO para América Latina y el Caribe. Montevideo, Uruguay. [ISBN 92-31810-4].

Lugo, A.E., F. Quiñones Marquez, and P.L. Weaver. La erosión y sedimentación en Puerto Rico. Caribbean Journal of Science 16(1-4):143-165.

Lugo, A.E., R.R. Twilley, and C. Patterson-Zucca. The role of black mangrove forests in the productivity of coastal ecosystems in south Florida. Final report to the United States Environmental Protection Agency. University of Florida, Center for Wetlands, Gainesville, Florida, USA.

National Academy of Sciences. Firewood crops: shrub and tree species for energy production. National Academy of Sciences, Washington, DC, USA. 237 p. [Frank H. Wadsworth was a member of the Ad Hoc Panel of the Advisory Committee on Technology Innovation, Board on Science and Technology for International Development, Commission on International Relations, the findings of which resulted in this report].

Schubert, T.H. Book review of: Voorhoeve, A.G. 1979. Liberian high forest trees. Agricultural Research Report 652, Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands. Journal of Forestry 78(11):705-706.

Wadsworth, F.H. Review of: Norman Myers. Conversion of tropical moist forests. Report prepared for the Committee on Research Priorities in Tropical Biology of the National Research Council, National Academy of Sciences, Washington, DC, USA. 205 p. American Forests 86(10):32.

Wadsworth, F.H. Review of: CEQ/State. Global 2000 report. *In* International Society of Tropical Foresters ISTF News 1(4):5.

Wadsworth, F.H. Review of: National Academy of Sciences. Research priorities in tropical biology. *In* International Society of Tropical Foresters ISTF News 1(4).

Wadsworth, F.H. Review of: Martin Chudnoff. Tropical timbers of the world. United States Forest Service, Forest Products Laboratory, Madison, Wisconsin, USA. 826 p. International Society of Tropical Foresters ISTF News 1(3):6.

Wadsworth, F.H. Review of: IUCN/UNESCO/FAO. World conservation strategy. *In* International Society of Tropical Foresters ISTF News 1(3):1; 3-4.

Wadsworth, F.H., editor. International Society of Tropical Foresters, ISTF News, Washington, DC, USA. 1(1-4):20 p.

Wadsworth, F.H. An ecologically sound approach for tropical forest management. Institute of Tropical Forestry Seminar. Institute of Tropical Forestry, Southern Forest Experiment Station, United States Department of Agriculture, Forest Service.

Weaver, P.L. Incremento periódico anual a largo plazo del DAP (DBH) en bosques naturales de Puerto Rico - implicaciones para su manejo. [Long term annual increment (DBH) in natural forests of Puerto Rico management implications]. Pages 42-56 *in* Proceedings of the Puerto Rico Department of Natural Resources Fifth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Weaver, P.L. Caracterización preliminar de los bosques secundarios de Puerto Rico. [Preliminary characterization of the secondary forests in Puerto Rico]. Pages 145-155 *in* Proceedings of the Puerto Rico Department of Natural Resources Sixth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Whitmore, J.L. Review of: R.F. Zacharin. 1978. Emigrant eucalypts. Melbourne University Press, Carlton, Victoria, Australia. 137 p. Journal of Forestry 78(1):39.

*Whitmore, J.L. and L.H. Liegel. Spacing trial of *Pinus caribaea* var. *hondurensis*. United States Forest Service Research Paper S0-162. 9 p.

Wiley, J.W. The Puerto Rican parrot: (*Amazona vittata*): its decline and the program for its conservation. Pages 133-159 *in* R.F. Pasquir, editor. Conservation of New World Parrots: Proceedings of the ICBP Parrot Working Group Meeting in St. Lucia, 1980. International Council for Bird Preservation Technical Publication No. 1. Smithsonian Institution Press, Washington, DC, USA.

Zerbe, J.L., J.L. Whitmore, H.E. Wahlgren, J.F. Laundrie, and K.A. Christopherson. Forestry activities and deforestation problems in developing countries. Report to Office of Science and Technology, Development Support Bureau, Agency for International Development, United States Department of State PASA No. AG/TAB-1080-10-78. United States Forest Service, Forest Products Laboratory, Madison, Wisconsin, USA. 115 pages + appendices.

1981

Brinson, M.M., A.E. Lugo, and S. Brown. Primary and productivity, decomposition, and consumer activity in freshwater wetlands. Annual Review of Ecology and Systematics 12:123-161.

Brown, S. and A.E. Lugo. Management and status of United States Commercial Marine Fisheries. Council on Environmental Quality, Washington, DC, USA. 45 p.

Brown, S. and A.E. Lugo. The role of terrestrial biota in the global CO_2 cycle. American Chemical Society, Division of Petroleum Chemistry, Inc. Reprints 26(4):1019-1025.

Cintrón, G., A.E. Lugo, R. Martínez, B.B. Cintrón, and L. Encarnación. Impact of oil in the tropical marine environment. Technical Publication, Division of Marine Resources, Department of

Natural Resources of Puerto Rico. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico. 36 p. + figs.

Geary, T.F. and R.W. Nobles. Selection of some exotic tree species for planting in St. Croix, Virgin Islands. Pages 303-307 *in* J.L. Whitmore, editor. Wood production in the neotropics via plantations. Proceedings of IUFRO Working Group S1-07-09. September 8-12, 1980. IUFRO/MAB/United States Forest Service, Washington, DC, USA.

*Ledig, F.T. and J.L. Whitmore. The calculation of selection differential and selection intensity to predict gain in a tree improvement program for plantation-grown Honduras pine in Puerto Rico. United States Forest Service Research Paper S0-170. 7 p.

Ledig, F.T. and J.L. Whitmore. Heritability and genetic correlations for volume foxtails and other characteristics of Caribbean pine in Puerto Rico. Silvae Genetica 30(2-3):88-92.

Liegel, L.H. Seasonal nutrition of 3- and 4-year-old *Pinus caribaea* foxtails and normal-branched trees in Puerto Rico. Ph.D. Thesis. North Carolina State University, Raleigh, North Carolina, USA. Dissertation Abstracts International 42(7).

*Lugo, A.E. The inland mangroves of Inagua. Journal of Natural History 15:845-852.

Lugo, A.E. Mangrove issue debates in courtrooms. Pages 48-60 *in* R.C. Carey, P.S. Markovits, and J.B. Kirkwood, editors. Proceedings of the United States Fish and Wildlife Service Workshop on Coastal Ecosystems of the Southeastern United States. FWS/OBS-80/59. United States Fish and Wildlife Service, Office of Biological Services, Washington, DC, USA.

Lugo, A.E. and S. Brown. Almacenaje y producción de materia orgánica en los bosques de Puerto Rico [Potential storage and production of organic matter in Puerto Rican forests]. Pages 49-68 *in* Puerto Rico Department of Natural Resources Seventh Symposium of Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico. [Also published as: Tropical forests as an energy source. Chapter V *in* Symposium Papers, Fuels and Environment from Tropical Biomass. University of Puerto Rico Center for Energy and Environment Research CEER-B-104; November 24-25, 1980, San Juan, Puerto Rico].

Lugo, A.E. and S. Brown. Ecological interpretation of atmospheric CO_2 data. Bulletin of the Ecological Society of America 62(2):61 (abstract).

*Lugo, A.E. and S. Brown. Ecological monitoring in the Luquillo Experimental Forest Biosphere Reserve. Ambio 10(23):102-107.

Lugo, A.E. and S. Brown. Tropical ecosystems and the human factor. A review of Myers, Norman. 1978. Conversion of tropical moist forests. National Academy of Sciences, Washington, DC, 205 p. Unasylva 33(133):45-49.

Lugo, A.E. and S. Brown. Tropical lands: popular misconceptions. Mazingira 5(2):10-19.

Lugo, A.E. and S. Brown. Las regiones tropicales: algunos conceptos confusos. Mazingira 5(2):9-18.

Lugo, A.E., G. Cintrón, and C. Goenaga. Mangrove ecosystems under stress. Chapter 11, pages 129-153 *in* G.W. Barrett and R. Rosenberg, editors. Stress Effects on Natural Ecosystems. John Wiley and Sons Limited, Sussex, England.

Lugo, A.E. and J.F. McCormick. Influence of environmental stressors upon energy flow in a natural terrestrial ecosytem. Chapter 8, p. 74-102 *in* G.W. Barrett and R. Rosenberg, editors. Stress Effects on Natural Ecosystems. John Wiley and Sons Limited, Sussex, England.

Lugo, A.E. and G. Morris. La humanidad y los sistemas ecológicos [Humanity and ecological systems]. Centro Interamericano de Desarrollo Integral de Aguas y Tierras, Mérida, Venezuela. 112 p.

*Lugo, A.E., R. Schmidt, and S. Brown. Tropical forests in the Caribbean. Ambio 10(6):318-324.

Lugo, A.E., R. Schmidt, and S. Brown. Preliminary estimates of storage and production of stemwood and organic matter in tropical tree plantation. Pages 8-16 *in* J.L. Whitmore, editor. Wood production in the neotropics via plantations. Proceedings of IUFRO Working Group S1-07-09. September 8-12, 1980. IUFRO/MAB/United States Forest Service, Washington, DC, USA.

Medina E., E. Cuevas, and P.L. Weaver. Composición foliar y transpiración de especies leñosas de Pico del Este, Sierra de Luquillo, Puerto Rico. Acta Científica Venezolana 32:159-165.

Schmidt, R. and P.L. Weaver. Tree diameter increment in the subtropical moist life zone of Puerto Rico. Turrialba 31(3):261-263.

Wadsworth, F.H. Management of a tropical forest. Pages 50-51 *in* Social and Economic Consequences of Natural Resources Policies with Special Emphasis on Biosphere Reserves. Proceedings of an International Seminar, April 8-13, 1980, Durango, Mexico. United States Forest Service General Technical Report RM-88.

Wadsworth, F.H. Management of forest lands in the humid tropics under sound ecological principles. Pages 168-180 *in* F. Mergen, editor. Tropical Forests: Utilization and Conservation, Yale University, New Haven, Connecticut, USA.

Wadsworth, F.H. Principles of management for sustained yield: evaluation and prospects. Pages 81-88 *in* Simposio Internacional sobre las Ciencias Forestales y su Contribución al Desarrollo de America Tropical. San José, Costa Rica, 11 al 17 de octubre de 1979, CONICIT & SCITEC, San José, Costa Rica.

Wadsworth, F.H. Hill forest silviculture for Sarawak. Field Document No. 13. FO:MAL/76/008, Forestry Development Project Sarawak. United Nations Development Program, Food and Agriculture Organization of the United Nations, Kuching, Malaysia. 40 p.

Weaver, P.L. Ecological aspects and value of dwarf forest in the Caribbean. Caribbean Conservation News 2(8):13-16.

Weaver, P.L. Growth and yield, and sample plot techniques in indigenous forests of the American tropics. *In* Proceedings of IUFRO/FAO Meeting on Growth and Yield in Mixed Tropical Forests at College of Forestry, Los Baños, Philippines.

Weaver, P.L. and A.E. Lugo. Forestry in St. Lucia. Pages 94-158 *in* D.J. Pool, G.L. Morris, P.L. Weaver, and A.E. Lugo, editors. Volume I - St. Lucia. Caribbean Agricultural Research and Development Institute for the United States Agency for International Development, Washington, DC, USA.

Whitmore, J.L. *Cedrela* provenance trial in Puerto Rico and Saint Croix: three years after outplanting. Pages 145-162 *in* Anais do I Congresso Brasileiro de Florestas Tropicais. Ist. Volume, 21-25 October, 1974. Universidade Federal Vicosa, Vicosa, Minas Gerais, Brazil.

Whitmore, J.L. *Eucalyptus deglupta, E. urophylla* and *E. alba* provenances in Puerto Rico. Pages 379-385 *in* J.L. Whitmore, editor. Wood Production in the Neotropics Via Plantations. Proceedings of IUFRO Working Group S1-07-09. September 8-12, 1980. IUFRO/MAB/United States Forest Service, Washington, DC, USA.

Whitmore, J.L., editor. Wood production in the neotropics via plantations. Proceedings of IUFRO Working Group S1-07-09. September 8-12, 1980. IUFRO/MAB/United States Forest Service, Washington, DC, USA. 393 p. [Also edition in Spanish].

Whitmore, J.L. and N.F. de Barros. *Pinus kesiya* and *P. merkusii* provenance trial in Puerto Rico. Pages 368-378 *in* J.L. Whitmore, editor. Wood production in the neotropics via plantations. Proceedings of IUFRO Working Group S1-07-09. September 8-12, 1980. IUFRO/MAB/United States Forest Service, Washington, DC, USA.

1982

*Birdsey, R.A. and P.L. Weaver. The forest resources of Puerto Rico. United States Forest Service Research Bulletin S0-85. 59 p.

Brown, S., G. Gertner, A.E. Lugo, and J. Novak. Carbon dioxide dynamics of the biosphere. Pages 19-28 *in* W.J. Mitsch, R.W. Basserman, and J.M. Klopatek, editors. Energy and Ecological Modelling. Elsevier Scientific Publishing Co., Amsterdam, The Netherlands.

Brown, S. and A.E. Lugo. A comparison of structural and functional characteristics of saltwater and freshwater forested wetlands. Pages 109-130 *in* B. Gopal, R.E. Turner, R. Wetzer, and D.F. Whigham, editors. Wetlands: Ecology and Management. National Institute of Ecology and International Scientific Publications, Jaipur, India.

*Brown, S. and A.E. Lugo. The storage and production of organic matter in tropical forests and their role in the global carbon cycle. Biotropica 14(3):161-187.

Brown, S., A.E. Lugo, and G. Gertner. Ecological interpretation of atmospheric $C0_2$ concentration of Mauna Loa. Pages 1-8 *in* S. Brown, editor. Global dynamics of biospheric carbon. CONF-8108131. United States Department of Energy, Washington, DC, USA.

*Liegel, L.H. Major issues of plantation establishment on small Caribbean islands. Pages 83-92 *in* A.E. Lugo and S. Brown, editors. Forestry in the Caribbean: Proceedings of the First Workshop of Caribbean Foresters, May 24-28, 1982, Castries, St. Lucia, United States MAB Report No. 7. United States Man and the Biosphere Program, Washington, DC, USA.

*Lugo, A.E. La naturaleza y límites del ecosistema puertorriqueño [Nature and limits of the Puerto Rican island ecosystems]. Boletín de la Academia de Artes y Ciencias de Puerto Rico 19(1-2):1-33.

Lugo, A.E. Some aspects of the interaction among nutrient cycling, hydrology, and in wetlands. Water International 7(4):178-184.

*Lugo, A.E. and S. Brown. Deforestation in the Brazilian Amazon. Interciencia 7(6):361-362.

Lugo, A.E. and S. Brown. Conversion of tropical moist forests: a critique. Interciencia 7(2):89-93.

*Lugo, A.E. and S. Brown, editors. Forestry in the Caribbean: Proceedings of the First Workshop of Caribbean Foresters, May 24-28, 1982, Castries, St. Lucia. United States MAB Report No. 7. United States Man and the Biosphere Program, Washington, DC, USA. 137 p.

Lugo, A.E. and S. Brown. Rebuttal to the "response to the Lugo Brown critique by Myers." Interciencia 7(2):89-93.

Lugo, A.E. and S. Brown. The role of tropical forests in the global carbon cycle: state of understanding. Pages 15-130 *in* S. Brown, editor. Global dynamics of biospheric carbon. CONF-8108131. United States Department of Energy, Washington, DC, USA.

Lugo, A.E. and G.L. Morris. Los sistemas ecológicos y la humanidad [Ecological systems and humanity]. Monografía No. 23, Serie de Biología. Secretaria General de la Organización de los Estados Americanos [Organization of American States] Programa Regional de Desarrollo Científico y Tecnológico, Washington, DC, USA. 82 p.

Murphy, P.G. and A.E. Lugo. Seasonal dynamics and succession in a tropical dry forest near Guánica, Puerto Rico. Bulletin of the Ecological Society of America 63(2):153 (abstract).

Savage, J.M., C.R. Goldman, D.P. Janos, A.E. Lugo, P.H. Raven, P.A. Sánchez, and H. Garrison. Ecological aspects of development in the humid tropics. National Academy Press, Washington, DC, USA. 297 p.

*Schubert, T.H. and J.A. Zambrana. *Araucaria heterophylla* and *Pinus caribaea*: potential Christmas trees for Puerto Rico. Journal of Agriculture of the University of Puerto Rico 66(2):145-149.

Wadsworth, F.H. Review of: Julian Evans. 1982. Plantation forestry in the tropics. *In* International Society of Tropical Foresters ISTF News 3(4):2.

Wadsworth, F.H. Book review of: Bormann, F.H. and G. Berlyn, editors. 1981. Age and growth rate of tropical trees. Bulletin No. 94. School of Forestry and Environmental Studies, Yale University, New Haven, Connecticut. American Forests 88(1):60, 63.

Wadsworth, F.H. Timber and forest energy development potentials for Puerto Rico. Part III, 17 p., *in* Proceedings of Fuels and Feedstocks from Tropical Biomass II, held April 26-28, 1982 in San Juan, Puerto Rico. CEER B-207. Terrestrial Biomass Division, UPR Center for Energy and Environment Research, Río Piedras, Puerto Rico.

Weaver, P.L. Tree diameter increment in an upper montane forest of Puerto Rico. Turrialba 32(2):119-122.

Weaver, P.L. Watershed management in the Caribbean Islands--an outline of principles and concepts. Pages 72-82 *in* A.E. Lugo and S. Brown, editors. Forestry in the Caribbean: Proceedings of the First Workshop of Caribbean Foresters, May 24-28, 1982, Castries, St. Lucia. United States MAB Report No. 7. United States Man and the Biosphere Program, Washington, DC, USA.

Weaver, P.L. and R.A. Birdsey. Bosques secundarios como fuente de madera: técnicas de evaluación y manejo. Pages 32-53 *in* Curso de Capacitación de Personal del Proyecto de Apoyo a Comunidades Nativas, Comité Nacional del Programa el Hombre y la Biosfera, Iquitos, Perú.

1983

*Birdsey, R.A. and P.L. Weaver. Puerto Rico's timberland. Journal of Forestry 81(10):671-672, 699.

*Brown, S., A.E. Lugo, S. Silander, and L.H. Liegel. Research history and opportunities in the Luquillo Experimental Forest. United States Forest Service General Technical Report S0-44. 128 p.

Cintrón, B.B. Coastal freshwater swamp forests: Puerto Rico's most endangered ecosystem? Pages 249-282 *in* A.E. Lugo, editor. Los bosques de Puerto Rico. Institute of Tropical Forestry, Southern Forest Experiment Station, United States Forest Service, Río Piedras, Puerto Rico and the Puerto Rico Department of Natural Resources, Puerta de Tierra, Puerto Rico.

Figueroa, J.C. and R. Schmidt. Caracterizacion y estructura de dos bosques en bosque pluvial sobre suelos serpentinos, Maricao, Puerto Rico. Pages 27-42 *in* Puerto Rico Department of Natural Resources Eighth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Frangi, J.L. and A.E. Lugo. Structure and dynamics of a *Prestoea montana* floodplain forest in the Luquillo Experimental Forest Biosphere Reserve in Puerto Rico. Bulletin of the Ecological Society of America 64(2):113 (abstract).

Krochmal, A. and C. Krochmal. Puerto Rico's tree ferns. LAIFS Journal 10(3):56-57.

Liegel, L.H. Growth, development and hurricane resistance of Honduras pine in Puerto Rico. Pages 28-48 *in* Puerto Rico Department of Natural Resources Ninth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Liegel, L.H. Susceptibility of *Pinus caribaea* and *Pinus oocarpa* provenances to rain/wind damage from cyclonic storms in Puerto Rico. Universidad Federal de Vicosa, Brazil. Man and the Biosphere, Washington, DC; International Union of Forest Research Organizations, Switzerland. p. 442.

*Liegel, L.H. Effects of dry-heat sterilization on chemical properties of Puerto Rican soils. Communications in Soil Science and Plant Analysis 14(4):277-286.

Liegel, L.H. Results from 20-year old spacing trials of *Pinus caribaea* var. *hondurensis* in Puerto Rico. Universidad Federal de Vicosa, Brazil; Man and the Biosphere, Washington, DC; International Union of Forest Research Organization, Switzerland. p. 443.

Liegel, L.H., R.D. Barnes, and G. Gibson. Crescimento e avaliacoes de caracteristicas selecionadas de testes de procedencias de *Pinus caribaea* e *Pinus oocarpa* em Porto Rico. Silvicultura 8(29):107-111.

Lugo, A.E. Definición, clasificación, funcionamiento y valor ecológico de tierras pantanosas. Page 226-232 *in* A.E. Lugo, editor. Los bosques de Puerto Rico. United States Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico and Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Lugo, A.E., M. de la P. Patiño Ruiz, 0. Mayoral Gómez (and others). Models of energy flow for rural planning in the Ebro River watershed. Options: Serie Etudes. Institut Agronomique Mediterraneen de Zaragoza, Zaragoza, Spain. 71 p.

Lugo, A.E. and F. Quiñones. Organic carbon export from intensively used watersheds in Puerto Rico. SCOPE/UNEP Special Issue. Mitt. Geol-Palaontology Institute, University of Hamburg 55:237-242.

Lugo, A.E. Organic carbon export by riverine waters in Spain. SCOPE/UNEP Special Issue. Mitt. Geol-Palaontology Institute, University of Hamburg 55:267-279.

Lugo, A.E. Coastal forests of Puerto Rico. Pages 177-203 *in* A.E. Lugo, editor. Los bosques de Puerto Rico. Institute of Tropical Forestry, Southern Forest Experiment Station, United States Forest Service, Río Piedras, Puerto Rico and Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Lugo, A.E. Influence of green plants on the world carbon budget. Pages 391-398 *in* T.N. Veziroglu, editor. Alternative energy sources V. Part E: Nuclear/Conservation/Environment. Elsevier Science Publishers, Amsterdam, The Netherlands.

Lugo, A.E. Forest research in Puerto Rico. Pages 6-34 *in* A.E. Lugo, editor. Los bosques de Puerto Rico. Institute of Tropical Forestry, Southern Forest Experiment Station, United States Forest Service, Río Piedras, Puerto Rico and Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Lugo, A.E., editor. Los bosques de Puerto Rico. Institute of Tropical Forestry, Southern Forest Experiment Station, United States Forest Service, and Puerto Rico Department of Natural Resources, San Juan, Puerto Rico. 321 p.

*Lugo, A.E. and C. Patterson-Zucca. Comparison of litterfall and turnover in two Florida ecosystems. Florida Scientist 46(2):101-110.

*Lugo, A.E., M.Applefield, D.J. Pool, and R.B. McDonald. The impact of Hurricane David on the forests of Dominica. Canadian Journal of Forestry Research 13(2):201-211.

Murphy, P.G., A.E. Lugo, and A.J. Murphy. Seasonal dynamics and recovery of a Caribbean dry forest. Bulletin of the Ecological Society of America 63(2):113 (abstract).

National Academy of Sciences. Firewood crops: shrub and tree species for energy production. Volume 2. National Academy of Sciences, Washington, DC. USA. 92 p. [Frank H. Wadsworth was a member of the Ad Hoc Panel of the Advisory Committee on Technology Innovation, Board on Science and Technology for International Development, Office of International Affairs, the findings of which resulted in this report].

*Tosi, J.A., Jr. and L.L. Vélez-Rodriguez. Provisional ecological map of the Republic of Brazil. Institute of Tropical Forestry, Southern Forest Experiment Station, United States Forest Service, Center for Energy and Environment Research, University of Puerto Rico, and United States Department of Energy, Washington, DC, USA. 16 p. + appendix; map. [Commissioned and edited by ITF and co-published by ITF as part of grant from DOE].

*Wadsworth, F.H. Production of usable wood from tropical forests. Pages 279-288 *in* F.B. Golley, editor. Tropical rain forest ecosystems, A. Structure and function. Chapter 17. Elsevier Scientific Publishing Company, Amsterdam, The Netherlands.

Wadsworth, F.H. and Birdsey, R.A. Un nuevo enfoque de los bosques de Puerto Rico. Pages 12-27 *in* Puerto Rico Department of Natural Resources Ninth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Weaver, P.L. Forestry research in the Tapajos National Forest, Santarem, Brazil. Technical Report FAO(FO:BRA/82/008). Food and Agriculture Organization of the United Nations, Brasilia, Brazil. 71 p.

Weaver, P.L. Monitoring of stand changes and growth in the forests of Puerto Rico. Pages 43-59 *in* Puerto Rico Department of Natural Resources Eighth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

*Weaver, P.L. Tree growth and stand changes in the subtropical life zones of the Luquillo Mountains of Puerto Rico. United States Forest Service Research Paper S0-190. 24 p.

Weaver, P.L. Book review of: Mergen, F., editor. 1981. Tropical forests: utilization and conservation. American Forests 89(1):63.

Weaver, P.L. and G.P. Bauer. Crecimiento de caoba sembrada en líneas en la sierra de Luquillo de Puerto Rico. Pages 31-39 *in* Décimo Simposio de Recursos Naturales. Department of Natural Resources, San Juan, Puerto Rico.

Weaver, P.L. and Woodbury, R. Vegetation survey on St. John, U.S. Virgin Islands. Pages 169-183 *in* Puerto Rico Department of Natural Resources Ninth Symposium on Natural Resources. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

Wiley, J.W. The role of captive propagation in the conservation of the Puerto Rican parrot. Pages 441-453 *in* G.L. Schulman, editor. Proceedings of the Jean Delacour/IFCB Symposium on Breeding Birds and Captivity. International Foundation for Conservation of Birds, Los Angeles, California, USA.

1984

Arendt, W.J. and T.A. Vargas Mora. Range expansion of the Shiny Cowbird in the Dominican Republic. Journal of Field Ornithology 55(1):104-107.

*Brown, S. and A.E. Lugo. Biomass of tropical forests: a new estimate based on forest volumes. Science 223:1290-1293.

Brown, S., A. Glubczynski, and A.E. Lugo. Effects of land use and climate on the organic carbon content of tropical forest soils in Puerto Rico. Pages 204-209 *in* New forests for a changing world. Proceedings of the Convention of the Society of American Foresters; October 16-20, 1983; Portland, Oregon. Society of American Foresters, Washington, DC, USA.

Faaborg, J. and W.J. Arendt. Population sizes and philopatry of winter resident warblers in Puerto Rico. General Notes. Journal of Field Ornithology 55(3):376-378.

Faaborg, J., W.J. Arendt, and M.S. Kaiser. Rainfall correlates of bird population fluctuations in a Puerto Rican dry forest: a nine year study. Wilson Bulletin 96(4):575-593.

*Figueroa, J.C., L. Totti, A.E. Lugo, and R.O. Woodbury. Structure and composition of moist coastal forsts in Dorado, Puerto Rico. United States Forest Service Research Paper SO-202. 11 p.

Liegel, L.H. Regional assessments of *Pinus caribaea* growth and yield on diverse soils in selected countries of the Caribbean Basin. Pages 356-357 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Ten-year growth results of *Pinus caribaea* and *Pinus oocarpa* provenance trials in Puerto Rico. Pages 326-327 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Results of 5- to 6-year-old provenance trials of *Pinus oocarpa* Schiede on eight sites in Puerto Rico. Silvae Genetica 33(6)223-230.

*Liegel, L.H. Status, growth, and development of unthinned Honduras pine plantations in Puerto Rico. Turrialba 34(3):313-324.

Liegel, L.H. Density effect on *Pinus caribaea* growth at 18- to 20-year in Puerto Rico. Pages 560-561 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Growth and performance in young *Pinus oocarpa* provenance trials in Puerto Rico in eight sites. Pages 324-325 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Growth and performance in young *Pinus caribaea* provenance trials in Puerto Rico in eight sites. Pages 320-321 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Growth and selection traits of Mt. Pine Ridge, Belize, plus-tree tree progeny in Puerto Rico at 11.6 years. Pages 554-555 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Height and diameter growth correlations with soil variables for normal-branched and foxtail *Pinus caribaea* provenances in Puerto Rico. Pages 322-323 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Hurricane susceptibility of *Pinus caribaea* and *Pinus oocarpa* provenances in Puerto Rico. Pages 318-319 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Normal-branched and foxtail *Pinus caribaea* and diameter growth correlations with several foliage variables in Puerto Rico. Pages 358-359 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

Liegel, L.H. Overall growth of early-distributed Mountain Pine Ridge *Pinus caribaea* seed sources in Puerto Rico. Pages 562-563 *in* R.D. Barnes and G.L. Gibson, editors. Provenance and genetic improvement strategies in tropical forest trees. April 9-14, 1984. Mutare, Zimbabwe. Commonwealth Forestry Institute, Oxford, United Kingdom.

*Liegel, L.H. Assessment of hurricane rain/wind damage in *Pinus caribaea* and *Pinus oocarpa* provenance trials in Puerto Rico. Commonwealth Forestry Review 63(1):47-53.

*Liegel, L.H. Effects of adding magnesium nitrate before dry-ashing on phosphorus in Honduras pine foliage. Research Note. Journal of Agriculture of the University of Puerto Rico 68(2):219-221.

Lugo, A.E. and S. Brown. Research and training needs in the tropics: the need for re-evaluation. Pages 57-70 *in* F. DiCastri, F.W.G. Baker, and M. Hadley, editors. Ecology in practice, Part I: Ecosystem management. Tycooly International Publishing Limited, Dublin, Ireland. UNESCO, Paris, France.

Lugo, A.E. Mangroves and pollution. Pages 171-175 *in* Jin-Eong Ong and Wooi-Khoon Gong, editors. Productivity of the mangrove ecosystem: management implications. Proceedings of the Workshop Spronsored by UNESCO/UNDP Regional Project Research and Training Pilot Programme on Mangrove Ecosystems in Asia and Oceania. October 4-6, 1983. Penang, Malaysia. Universiti Sains, School of Biological Sciences, Penang, Malaysia.

Lugo, A.E. Overview of mangrove productivity. Page 9 *in* Jin-Eong Ong and Wooi-Khoon Gong, editors. Productivity of the mangrove ecosystem: management implications. Proceedings of the Workshop Spronsored by UNESCO/UNEP Regional Project Research and Training Pilot Programme on Mangrove Ecosystems in Asia and Oceania. October 4-6, 1983. Penang, Malaysia. Universiti Sains, School of Biological Sciences, Penang, Malaysia (abstract).

Lugo, A.E. Case studies on forestry activities in the eastern Caribbean and Jamaica: recommendations by students of the Tropical Forstry and Environmental Quality courses held at the Institute of Tropical Forestry in Río Piedras. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 143 p.

Lugo, A.E. A review of early literature on forested wetlands in the United States. Pages 7-15 *in* K.C. Ewel and H.T. Odum, editors. Cypress swamps. University of Florida Press, Gainesville, Florida, USA.

Lugo, A.E. and S. Brown. Conserving tropical rainforest ecosystems: assessing coverage and assigning priorities. Pages 37-43 *in* UNESCO/UNEP. Conservation, Science, and Society: Dontributions to the First International Biosphere Reserve Congress, Minsk, Byelorussia/USSR. September 26 - October 2, 1983. Organized by UNESCO and UNEP in cooperation with FAO and IUCN at the invitation of the USSR. UNESCO, Paris, France.

Lugo, A.E. and J. Figueroa. *Anthocephalus chinensis* (Lam.) A. Rich. ex Walp. Kadam. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, USA. SO-ITF-SM-1. 6 p.

Lugo, A.E., J.K. Nessel, and T.M. Hanlon. Root distribution in a north-central Florida cypress stand. Pages 279-285 *in* K.C. Ewel and H.T. Odum, editors. Cypress swamps. University of Florida Press, Gainesville, Florida, USA.

Lugo, A.E. and S.L. Brown. The Oklawaha river forested wetlands and their response to chronic flooding. Pages 365-373 *in* K.C. Ewel and H.T. Odum, editors. Cypress swamps. University of Florida Press, Gainesville, Florida, USA.

*Mosquera, M. and J. Feheley, compilers. Bibiliography of forestry in Puerto Rico. United States Forest Service General Technical Report SO-51. 196 p.

Wadsworth, F.H. Secondary forest management and plantation forestry technologies to improve the use of converted tropical lands. *In* Technologies to sustain tropical forest resources. OTA-F-214. Office of Technology Assessment, United States Congress, Washington, DC, USA.

Wadsworth, F.H. La deforestación, muerte del Canal de Panamá. Pages 167-174 *in* S. Heckadon Moreno and A. McKay, editors. Colonización y destrucción de bosques en Panamá. Asociación Panameña de Antropología.

Wadsworth, F.H. Informe del grupo de estudios de silvicultura. Pages 6e-7e *in* Proceedings of the 12th Meeting of the North American Forstry Commission. February 21-24, 1984. El Paso, Texas.

Wiley, J.W. Status of the osprey in the West Indies. Pages 9-16 *in* M.A. Westfall, editor. Proceedings of the Southern United States and Caribbean Osprey Symposium. June 4-5, 1983. Sanibel Island, Florida. International Osprey Foundation, Sanibel Island, Florida.

1985

*Acevedo-Rodriguez, P. en colaboracion con R.O. Woodbury. Los bejucos de Puerto Rico. Volumen I. Forest Service General Technical Report SO-58. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 331 p.

Arendt, W.J. *Philornis ectoparasitism* of pearly-eyed thrashers. 2. Effects on adults and reproduction. Auk 102:281-292.

Arendt, W.J. Wildlife assessment of the Southeastern Peninsula, St. Kitts, West Indies, (Report). United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 24 p. + tables, figures, and appendix.

Arendt, W.J. *Philornis ectoparasitism* of pearly-eyed thrashers. 1. Impact on growth and development of nestlings. Auk 102:270-280.

Birdsey, R.A., P.L. Weaver, and C.F. Nichols. The forest resources of St. Vincent. Pages 35-102 *in* A.E. Lugo, editor. Development, forestry, and environmental quality in the eastern Caribbean. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico.

*Birdsey, R.A. and D. Jimenez. The forests of Toro Negro. Research Paper SO-222. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 29 p.

Brown, S. and A.E. Lugo. Deforestation of tropical rain forest. Pages 252-253 *in* D.D. Churas, editor. Environmental sciences: a framework for decision making. Benjamin Cummings, Menlo Park, California, USA.

Cintron, G., A.E. Lugo, and R. Martínez. Structural and functional properties of mangrove forests. Pages 53-66 *in* W.G. D'Arcy and M.D. Correa, editors. The botany and natural history of Panama: La botanica e historia natural de Panama. Monographs in Systematic Botany, v.10. Missouri Botanical Garden, St. Louis, Missouri, USA.

Diaz, P.L., A.E. Lugo and W. McDowell. General hydrology and water quality of Layou River in Dominica, Buccament River in St. Vincent, and Troumassee River in St. Lucia, British West Indies. Pages 46-49*in* F. Quiñones and A.V. Sanchez, editors. International Symposium on Tropical Hydrology and 2nd Caribbean Islands Water Resources Congress. Proceedings of a symposium, May 5-8, 1985, San Juan, Puerto Rico. American Water Resources Association, Bethesda, Maryland, USA.

Diaz, P.L., A.E. Lugo, and W. McDowell. General hydrology and water quality of three rivers in the eastern Caribbean. Pages 144-156 *in* Proceedings of a CARDI-UNESCO-MAB Workshop, October 27-November l, 1985. Caribbean Agricultural Research and Development Institute, St. Lucia.

Diaz, P.L., A.E. Lugo, and W. McDowell. General hydrology and water quality of three rivers in the eastern Caribbean. Pages 11-35 *in* A.E. Lugo, editor. Development, forestry, and environmental quality in the eastern Caribbean. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico.

Faaborg, J. and W.J. Arendt. Wildlife assessments in the Caribbean. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 224 p.

*Frangi, J.L. and A.E. Lugo. Ecosystem dynamics of a subtropical floodplain forest. Ecological Monographs 55:351-369.

Institute of Tropical Forestry. Training manual for forestry technicians in the Caribbean: United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico.

*Jimenez, J.A. *Rhizophora mangle* L.-Red mangrove. SO-ITF-SM-2. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 7 p.

*Jimenez, J.A. *Laguncularia racemosa* (L.) Gaertn.f. White mangrove. SO-ITF-SM-3. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 4 p.

*Jimenez, J.A. and A.E. Lugo. *Avicennia germinans* (L.) L. Black mangrove. SO-ITF-SM-4. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 6 p.

Jimenez, J.A., A.E. Lugo, and G. Cintron. Tree mortality in mangrove forests. Biotropica 17(3):177-185.

*Liegel, L.H. Growth, form, and flowering of Caribbean pine families in Puerto Rico. Commonwealth Forestry Review 64(1):67-74.

Liegel, L.H. Issues of plantation forestry in watershed management on small Caribbean islands in the 1980's. Pages 147-154 *in* A.E. Lugo and S. Brown, editors. Watershed management in the Caribbean. Proceedings of the 2nd Workshop of Caribbean Foresters, March 19-23, 1984, Kingstown, Saint Vincent and the Grenadines. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico, United States Man and the Biosphere Program, UNESCO, Washington, DC, USA.

Liegel, L.H., W.E. Balmer, and G.W. Ryan. Honduras pine spacing trial results in Puerto Rico. Southern Journal of Applied Forestry 9(2):69-75.

*Liegel, L.H., R. Jones, G. Symes, B. Ramdial, and J.J. Cabrera Malo. US-AID supports study of Honduras pine in the Caribbean. Journal of Forestry 83(6):376-377.

Liegel, L.H. and A.E. Lugo. Damage and management of hurricane-prone forests in the Caribbean. Pages 103-122 *in* A.E. Lugo, editor. Development, forestry, and environmental quality in the eastern Caribbean. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico.

Lugo, A.E. Development, forestry and environmental quality in the eastern Caribbean. Pages 123-165 *in* A.E. Lugo, editor. Development, forestry and environmental quality in the eastern Caribbean. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico.

Lugo, A.E. Principles of sound watershed management. Pages 11-16 *in* A.E. Lugo and S. Brown, editors. Watershed management in the Caribbean. Proceedings of the 2nd Workshop of Caribbean Foresters, March-19-23, 1984, Kingstown, Saint Vincent and the Grenadines. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. United States Man and the Biosphere Program, UNESCO, Washington, DC, USA.

Lugo, A.E. Book review of: Snedaker, S.C. and J.G. Snedaker. 1984. The mangrove ecosystem: research methods. UNESCO, Paris. 251 p. *In* The Quarterly Review of Biology 60(4):532-533.

*Lugo, A.E. Countering the effects of tropical deforestation with modern technology. Pages 289-297 *in* R.R. Henke and K.W. Hughes, M.P. Constantin, A. Hollaender, editors. Tissue culture in forestry and agriculture. Plenum Publishing Corporation, New York, New York, USA.

*Lugo, A.E. An introduction to the forests of Puerto Rico. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 20 p.

Lugo, A.E. Development, forestry, and environmental quality in the eastern Caribbean. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 165 p.

Lugo, A.E. and S. Brown. Watershed management in the Caribbean. Proceedings of the 2nd Workshop of Caribbean Foresters, March 19-23, 1984, Kingstown, Saint Vincent and the Grenadines. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Washington, DC. U. S. Man and the Biosphere Program, Río Piedras, Puerto Rico. 157 p.

*Lugo, A.E. and J. Figueroa. Performance of *Anthocephalus chinensis* in Puerto Rico. Canadian Journal of Forest Research 15:577-585.

Schubert, T.H. Arboles para uso urbano en Puerto Rico e Islas Virgenes. General Technical Report SO-57. [Translation of: Schubert, T.H. 1979. Trees for urban use in Puerto Rico and the Virgin Islands. United States Forest Service General Technical Report SO-271]. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 87 p.

Venator, C.R. and L.H. Liegel. Manual de viveros mecanizados para plantas a raiz desnuda y sistema semimecanizado con recipientes de volumenes menor a 130 cc. Ministerio de Agricultura y Ganaderia, Programa Nacional Forestal y Agencia para el Desarrollo Internacional, Quito, Ecuador. 142 p.

Venator, C.R., L.H. Liegel, and J.P. Barnett. Bare-root versus container production of pines in the American tropics. *In* International Symposium of Nursery Management Practices for the Southern Pines, August 4-9, 1985. Montgomery, Alabama University, Auburn, Alabama, USA.

Wadsworth, F.H. La deforestacion, muerte del canal de Panama. Biocenosis 1(3):15-16.

Wadsworth, F.H. and R.A. Birdsey. A new look at the forests of Puerto Rico. Turrialba 35(1):11-17.

Weaver, P.L. and J.T. Valenta. Timber plantations and water resources on St. Vincent, West Indies. Pages 96-110 *in* A.E. Lugo and S. Brown, editors. Watershed management in the Caribbean. Proceedings of the 2nd Workshop of Caribbean Foresters, March 19-23, 1984, Kingstown, Saint Vincent and the Grenadines. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico, United States Man and the Biosphere Program, UNESCO, Washington, DC, USA.

Wiley, J.W. Shiny cowbird parasitism in two avian communities in Puerto Rico. Condor 87:165-176.

Wiley, J.W. The Puerto Rican Parrot and competition for its nest sites. Pages 213-223 *in* P.J. Moors, editor. Conservation of island birds. Proceedings of a Symposium, 1982, ICBP World Conference, Cambridge, England. ICBP Technical Publication 3, Cambridge, England.

Wiley, J.W. The captive programme for the endangered Puerto Rican Parrot *Amazona vittata.* Avicultural Magazine 91(2):110-116.

Wiley, J.W. and G. Bauer. Site guide: Caribbean National Forest, Puerto Rico, 12-18.

1986

Arendt, W.J. An observation of *Iguana iguana* feeding on eggs of the cattle egret (*Bubulcus ibis*) at Fox Bay Montserrat, West Indies: a case of predation or scavenging? Caribbean Journal of Science 22(3-4):221-222.

Arendt, W.J. Bat predation by the St. Lucia boa (*Boa constrictor orophias*). Research Note. Caribbean Journal of Science 22(3-4):219-220.

Arendt, J.W. and A.I. Arendt. Bill deformity in a Pearly-eyed Thrasher from Montserrat, West Indies, North American Bird Bander 11(2):51-52.

*Birdsey, R.A., P.L. Weaver, and C.F. Nicholls. The forest resources of St. Vincent, West Indies. Forest Service Research Paper SO-229. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 25 p.

Brown, S., A.E. Lugo, and J. Chapman. Biomass of tropical tree plantations and its implications for the global carbon budget. Canadian Journal of Forest Research 16(2):390-394.

Cruz, A., T. Manolis, and J.W. Wiley. The shiny cowbird: a brood parasite expanding its range in the Caribbean region. Ecological Monographs 36:607-620.

Easley, D.F. and C.A. Maynard. Genetic variation in white spruce and production of improved material. Pages 124-133 *in* Tree improvement--theory and practice. Proceedings IUFRO conference: a Joint meeting of Working Parties on Breeding Theory, Progeny Testing, Seed Orchards, October 13-17, 1986, Williamsburg, Virginia. North Carolina State University, Tree Improvement Cooperative, Raleigh, North Carolina, USA.

Francis, J.K. Nutrient depletion by intensive harvest of southern bottomland hardwoods. Page 151 *in* Program of the IV International Congress of Ecology, August 10-16, 1986, State University of New York, Syracuse University, Syracuse, New York, USA. (abstract).

Liegel, L.H. Effects of sterilization procedures on the biological, chemical, and physical properties of soils: a review. Turrialba 36(1):11-19.

*Lugo, A. E. Mangrove understory: an expensive luxury?. Journal of Tropical Ecology 2:287-288.

Lugo, A.E. Water and the ecosystems of the Luquillo Experimental Forest. General Technical Report SO-63. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 17 p.

Lugo, A. E. and S. Brown. Brazil's Amazon forest and the global carbon problem. Interciencia 11(2):57-58.

Lugo, A.E. and O.L. Loucks. Prospects for regional and trans-national studies in the Man and the Biosphere Program. Page 222 *in* Program of the IV International Congress of Ecology, August 10-16, 1986, State University of New York, Syracuse University, Syracuse, New York, USA. (abstract).

Lugo, A.E. and P.G. Murphy. Nutrient dynamics of a Puerto Rican subtropical dry forest. Journal of Tropical Ecology 2:55-72.

Lugo, A.E., M.J. Sanchez, and S. Brown. Land use and organic carbon content of some tropical soils. Plant and Soil 96:185-196.

Lugo, A.E. and C.T. [Battle] Rivera. Long-term growth rate and age of a tropical palm. Page 222 *in* Program of the IV International Congress of Ecology, August 10-16, 1986, State University of New York, Syracuse University, Syracuse, New York, USA. (abstract).

Lugo, A.E., M.J. Sanchez and S. Brown. Land use and organic carbon content of some subtropical soils. Plant and Soil 96:185-196.

Lugo, A.E., M.M. Brinson, and S. Brown. Development of an integrated ecological research program for the Parana River in Argentina. Revista de la Asociacion de Ciencias Naturales del Litoral 17(2):137-155.

Lugo, A.E. and S. Brown. Steady state terrestrial ecosystems and the global carbon cycle. Vegetatio 68:83-90.

Murphy, P.G. and A.E. Lugo. Tree growth and primary productivity in a Caribbean dry forest. Page 249 *in* Program of the IV International Congress of Ecology. August 10-16, 1986, State University of New York, Syracuse University, Syracuse, New York, USA. (abstract).

*Murphy, P.G. and A.E. Lugo. Structure and biomass of a subtropical dry forest in Puerto Rico. Biotropica 18(2):89-96.

Murphy, P.G. and A.E. Lugo. Ecology of tropical dry forest. Annual Review of Ecology and Systematics 17:67-88.

Otis, G.W., E. Santana C., D.L. Crawford, and M.L. Higgins. The effect of foraging army ants on leaf-litter arthropods. Biotropica 18(1):56-61.

Santana, C.E., G.A. Potter, and S.A. Temple. Home range and activity patterns of turkey vultures in Puerto Rico. Caribbean Journal of Science 22(3-4):175-177.

Santana, C.E., E.N. Laboy, J.A. Mosher, and S.A. Temple. Red-tailed hawk nest sites in Puerto Rico. Wilson Bulletin 98(34):561-570.

Santana, C.E. and S.A. Temple. Status and seasonal patterns of abundance of turkey vultures in Puerto Rico. Journal of Field Ornithology 53(3):235-238.

Twilley, R.R., A.E. Lugo, and C. Patterson-Zucca. Litter production and turnover in basin mangrove forests in southwest Florida. Ecology 67(3):670-683.

Uhazy, L.S. and W.J. Arendt. Pathogenesis associated with philornidmyiasis (Diptera: Muscidae) on nestling pearly-eyed thrashers (Aves: Mimidae) in the Luquillo Rain Forest, Puerto Rico. Journal of Wildlife Diseases 22(2):224-237.

Wadsworth, F.H. A focus for forest conservation in Jamaica. Pages 3-11 *in* D.A. Thompson, P. K. Bretting, and M. Humphreys, editors. Forest of Jamaica. The Jamaican Society of Scientists and Technologists. Kingston, Jamaica.

Weaver, P.L. Hurricane damage and recovery in the montane forests of the Luquillo Mountains of Puerto Rico. Caribbean Journal of Science 22(1-2):53-70.

Weaver, P.L. La evaluacion de los recursos forestales secundarias y su potencial para el manejo de la masa forestal. Volumen 28, paginas 1-15 *en* Actas del Primer Seminario Internacional Sobre Manejo de Bosque Tropical Humedo en la Region de Centro America (SEMBOTH), 3-14 de noviembre de 1986. Escuela Nacional de Ciencias Forestales (ESNACIFOR), Siguatepeque, Honduras.

Weaver, P.L. Perturbaciones causadas por huracanes y recuperacion del bosque muy humedo montana baja de las montañas de Luquillo de Puerto Rico. Volumen 29, paginas 1-5 *en* Actas del Primer Seminario Internacional Sobre Manejo de Bosque Tropical Humedo en la Region de Centro

America (SEMBOTH), 3-14 de noviembre de 1986. Escuela Nacional de Ciencias Forestales (ESNACIFOR), Siguatepeque, Honduras.

Weaver, P.L. Recovery of the colorado forest of the Luquillo Mountains of Puerto Rico from hurricane damage. Pages 345-346 *in* Program of the IV International Congress of Ecology, August 10-16, 1986. State University of New York, Syracuse University, Syracuse, New York, USA. (abstract).

Weaver, P.L. Los efectos de los huracanes en los bosques de las montañas de Luquillo. Pages 38-50 *in* Proceedings of the Twelfth Symposium of Natural Resources, December 11-12, 1985, San Juan, Puerto Rico. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.

*Weaver, P.L. Growth and age of *Cyrilla racemiflora* L. in montane forests of Puerto Rico. Interciencia 11(5):221-228.

*Weaver, P.L. and G.P. Bauer. Growth, survival and shoot borer damage in mahogany plantings in Luquillo Forest in Puerto Rico. Turrialba 36(4):509-522.

Weaver, P.L. and .R.A. Birdsey. Tree succession and management opportunities in coffee shade stands. Turrialba 36(1):47-58.

Weaver, P.L., E. Medina, D. Pool, K. Dugger, J. González-Liboy and E. Cuevas. Ecological observations in the dwarf cloud forest of the Luquillo Mountains in Puerto Rico. Biotropica 18(1):79-85.

Wiley, J.W. Bird Conservation in the United States Caribbean. Pages 107-159 *in* S.A. Temple, editor. Bird Conservation 12. University of Wisconsin Press, Madison, Wisconsin, USA.

Wiley, J.W. Status and conservation of tropical forest birds of prey in the West Indies. Pages 199-204 *in* R. Chancellor and I. Newton, editors. Conservation studies on raptors. International Council for Bird Preservation. Technical Publication No. 5. Meeting on World Working Group on Birds of Prey, 1982, Greece.

1987

*Birdsey, R.A. and P.L. Weaver. Forest area trends in Puerto Rico. Forest Service Research Note SO-331. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 5 p.

Cruz, A. Avian community organization in a mahogany plantation on a neotropical island. Caribbean Journal of Science 23(2):286-296.

Figueroa Colon, J.C., F.H. Wadsworth and S. Branham, editors. Management of the Forests of Fropical America: Prospects and Technologies. Proceedings of a conference, September 22-27, 1986, San Juan, Puerto Rico. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 469 p.

Francis, J.K. Regrowth after complete harvest of a young bottomland hardwood stand. Pages 120-124 *in* Proceedings of the Fourth Biennial Southern Silvicultural Research Conference, November 4-6- 1986, Atlanta, Georgia. Forest Service General Technical Report SE-42. United States Department of Agriculture, Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina, USA.

Francis, J.K. Performance of exotic tree species in Puerto Rico. Pages 377-388 *in* J.C. Figueroa-Colón, F.H. Wadsworth, S. Braham, editors. Management of the Forest of Tropical America: Prospects and Technologies. Proceedings of a conference, September 22-27, 1986, San Juan, Puerto Rico. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico.

*Liegel, L.H. and C.R. Venator. A technical guide for forest nursery management in the Caribbean and Latin America. General Technical Report SO-67. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, USA. 156 p.

Lugo, A.E. Book review of: P.B. Tomlinson, editor. 1986. The botany of mangroves. Cambridge Tropical Biology Series. Cambridge University Press, New York. 413 p. Ecology 68(1):238-239.

Lugo, A.E. Avances y prioridades de investigación en manglares. Pages 59-76 *in* Watanabe, Shigueo, coord. Simposio Sobre Ecosistemas da Costa Sul e Sudeste Brasileira: Sintese dos Conhecimientos en Cananeia; April 11-16, 1987, Sao Paulo, Brazil. Academia de Ciencias do Estado de Sao Paulo, Sao Paulo, Brazil.

*Lugo, A.E. Tropical forest management. Book review of: C.F. Jordan, editor. Amazonian rain forests. Ecosystem disturbance and recovery. Ecological studies 50. 133 p. Journal of Forestry 86(10):44-47.

Lugo, A.E. Wood utilization research needs in the tropics. Pages 57-66 *in* Matching Utilization Research With the Needs of Timber Managers. Proceedings of Forest Products Research Conference, October 21-23, 1986. United States Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, Wisconsin, USA.

Lugo, A.E. Edad de los árboles y bosques de Puerto Rico. Acta Científica. 1(1):36-41.

Lugo, A.E., L.H. Liegel. Comparison of plantations and natural forests in Puerto Rico. Pages 41-44 *in* A.E. Lugo, J.J. Ewel, S.B. Hecht, P.S. Murphy, C. Padoch, M.C. Schmink, and D. Stone, editors. People and the tropical forest: a research report from the United States Man and the Biosphere Program. United States Man and the Biosphere (MAB) Program, Tropical and Subtropical Forests Directorate, Washington, DC, USA.

Lugo, A.E. and P.L. Díaz. General hydrology and water quality in eastern Caribbean islands. Pages 26-27 *in* A.E. Lugo, J.J. Ewel, S.B. Hecht, P.G. Murphy, C. Padoch, M.C. Schmink, and D. Stone, editors. People and the Tropical Forests: A Research Report from the United States Man the Biosphere (MAB) Program, Tropical and Subtropical Forests Directorate, Washington, DC, USA.

Lugo, A.E., J.J. Ewel, S.B. Hecht. P.G. Murphy, C. Padoch, M.C. Schmink, and D. Stone. People and the Tropical Forest: A Research Report from the United States Man and the Biosphere Program. United States Man and the Biosphere (MAB) Program, Tropical and Subtropical Forests, Directorate, Washington, DC, USA. 75 p.

*Lugo, A.E. and L.B. Ford. Forest recreation in the Caribbean islands. Proceedings of the Third Meeting of Caribbean Foresters, May 19-23, 1986. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico; United States Department of Agriculture, Forest Service, Caribbean National Forest, Río Piedras, Puerto Rico. 95 p.

Lugo, A.E. and C.T. Rivera Batlle. Leaf production, growth rate, and age of the palm *Prestoea montana* in the Luquillo Experimental Forest, Puerto Rico. Journal of Tropical Ecology 3:151-161.

Snyder, N.F., J.W. Wiley and C.B. Kepler. The parrots of Luquillo: natural history and conservation of the Puerto Rican parrot. Western Foundation of Vertebrate Zoology, Los Angeles, California, USA. 384 p.

Wadsworth, F.H. A time for secondary forestry in tropical America. Pages 189-197 *in* J.C. Figueroa-Colón, F.H. Wadsworth, S. Branham, editors. Management of the forests of tropical America: prospects and technologies. Proceedings of a conference, September 22-27, 1986, San Juan, Puerto Rico. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico.

Wadsworth, F.H. Applicability of Asian and African silviculture systems to naturally regenerated forests of the neotropics. Pages 93-111 *in* F. Mergen and J.F. Vincent, editors. Natural Management of Tropical Moist Forests: Silvicultural and Management Prospects of Sustained Utilization. Yale University, School of Forestry and Environmental Studies, New Haven, Connecticut, USA.

Wadsworth, F.H. Tree growth as a guide to the management of secondary tropical forests. Pages 57-60 *in* A.E. Lugo, J.J. Ewel, S.B.Hecht, P.G. Murphy, C. Padoch, M.C. Schmink, and D. Stone, editors. People and the Tropical Forest: A Research Report from the United States Man and the Biosphere Program. United States Man and the Biosphere (MAB) Program, Tropical and Subtropical Forests Directorate, Washington, DC, USA.

Wadsworth, F.H. Composition of trees in insular forest ecosystems. Acta Científica 1(2-3):77-80.

*Weaver, P.L. Ecological observations on *Magnolia splendens* Urban in the Luquillo Mountains of Puerto Rico. Caribbean Journal of Science 23(3-4):340-351.

Weaver, P.L. Enrichment plantings in tropical America. Pages 259-278 *in* J.C. Figueroa-Colón, F.H. Wadsworth, S. Branham, editors. Management of the Forests of Tropical America: Prospects and Technologies. Proceedings of a conference, September 22-27, 1986, San Juan, Puerto Rico. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico.

Weaver, P.L. Structure and dynamics in the colorado forest of the Luquillo Mountains of Puerto Rico. Ph.D. dissertation. Michigan State University, Department of Botany and Plant Pathology, East Lansing, Michigan, USA. 296 p.

*Weaver, P.L., R.A. Birdsey and A.E. Lugo. Soil organic matter in secondary forests of Puerto Rico. Biotropica 19(1):17-23.

Weaver, P.L. and J.D. Chinea-Rivera. A phytosociological study of Cinnamon Bay watershed, St. John, U.S. Virgin Islands. Report for United States Park Service, Caribbean Journal of Science 23(2):318-336.

Woodbury, R.O. and P.L. Weaver. The vegetation of St. John and Hassel Island, U.S. Virgin Islands. Research/Resources Management Report SER-83. United States Department of the Interior, National Park Service, Southeast Region, Atlanta, Georgia, USA. 101 p.

1988

*Arendt, W.J. and A.I. Arendt. Aspects of the breeding of the cattle egret (*Bubulcus ibis*) in Montserrat, West Indies, and its impact on nest vegetation. Colonial Waterbirds 11(1):72-84.

Arendt, W.J. Range expansion of the cattle egret (*Bubulcus ibis*) in the greater Caribbean basin. Colonial Waterbirds 11(2):252-262.

*Bokkestijn, A. and J.K. Francis [n.d.]. *Khaya senegalensis* Juss. Dry-zone mahogany. Meliaceae, Mahogany family. SO-ITF-SM-5. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 4 p.

Cruz, A. Avian resource use in a Caribbean pine plantation. The Journal of Wildlife Management 52(2):274-279.

*Francis, J.K. [n.d.]. *Agathis robusta* (C. Moore ex F. Muell) F.M. Bailey. Queensland kauri. Araucariacae, Araucaria family. SO-ITF-SM-10. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 5 p.

*Francis, J.K. [n.d.]. *Araucaria heterophylla* (Salisb.) Franco. Norfolk-island pine. Araucariaceae, Araucaria family. SO-ITF-SM-11. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 4 p.

*Francis, J.K. [n.d.]. *Hernandia sonora* L. Mago, toporite. Hernandiaceae, Hernandia family. SO-ITF-SM-13. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 3 p.

*Francis, J.K. [n.d.]. *Terminalia ivorensis* (A. Chev.) Idigbo, Emire. Combretaceae, Combretum family. SO-ITF-SM-12. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 5 p.

*Francis, J.K. [n.d.]. *Maesopsis eminii* Engl. Musizi. Rhamnaceae, Buckthorn family. SO-ITF-SM-8. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 4 p.

*Francis, J.K. and A. Bokkestijn [n. d.]. *Khaya nyasica* Stapf. ex Baker f. East African mahogany. Meliaceae, Mahogany family. SO-ITF-SM-9. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 4 p.

Francis, J.K. Araucariaceae in Puerto Rico. Turrialba 38(3):202-207.

*Francis, J.K. *Enterolobium cyclocarpum* (Jacq.) Griseb. Guanacaste, earpod-tree. Leguminosae, Legume family. SO-ITF-SM-15. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 4 p.

Francis, J.K. Merchantable volume table for Ucar in Puerto Rico. Research Note SO-350. United States Department of Agriculture, Forest Service, Southern Forest Experiment, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 3 p.

*Francis, J. K. *Eucalyptus deglupta* Blume. Kamarere. Myrtaceae, Myrtle family. SO-ITF-SM-16. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 5 p.

Francis, J.K. and P.L. Weaver. Performance of *Hibiscus elatus* in Puerto Rico. Commonwealth Forestry Review 67(4):327-338.

*Little Jr., E.L., R.O. Woodbury, and F.H. Wadsworth. Arboles de Puerto Rico y las Islas Vírgenes, Segundo Volumen. Agriculture Handbook No. 449-S. United States Department of Agriculture, Forest Service, Washington, DC, USA. 1177 p.

Lugo, A.E. Estimating reductions in the diversity of tropical forest species. Chapter 6 *in* F.M. Peter and E.O. Wilson, editors. Biodiversity. National Academy Press, Washington, DC, USA.

*Lugo, A.E. Uso de las zonas boscosas de América Latina Tropical. Interciencia 13(6):288-295.

Lugo, A.E. The mangroves of Puerto Rico are in trouble. Underwater Naturalist 17(3):11-12.

Lugo, A.E. The future of the forest: Ecosystem rehabilitation in the tropics. Environment 30(7):17-20, 41-45.

Lugo, A.E. Ecological aspects of catastrophes in Caribbean islands. Acta Científica 2(1):24-31.

*Lugo, A.E. Forest lands in Puerto Rico and the Caribbean 500 years after their discovery by Cristoforo Colombo. Slide presentation, includes references and an appendix. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico.

Lugo, A.E., S. Brown, and J. Chapman. An analytical review of production rates and stemwood biomass of tropical forest plantations. Forest Ecology and Management 23:179-200.

Lugo, A.E., S. Brown, and M.M. Brinson. Forested wetlands in freshwater and salt-water environments. Limnology & Oceanography 33(4):894-909.

Lugo, A.E., editor. Diversity of tropical species: questions that elude answers. Biology International. Special issue 19. International Union of Biological Sciences, Paris, France. 37 p.

Lugo, A.E., J.R. Clark, R.D. Child, editors. Ecological Development in the Humid Tropics: Guidelines for Planners. Winrock International, Institute for Agricultural Development, Morrilton, Arkansas, USA. 362 p.

*Parrota, J.A. [n.d.]. *Albizia lebbek* (L.) Benth. Siris. Leguminosae (Mimosaceae), Legume family. SO-ITF-SM-7. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 5 p.

*Parrota, J.A. [n.d.]. *Albizia procera* (Roxb.) Benth. White siris. Tall albizia. Leguminosae (Mimosaceae), Legume family. SO-ITF-SM-6. United States Department of Agriculture, Forest

Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 4 p.

Pérez, I.E. (Compiler). Field guide to the trees of Bisley watersheds, Luquillo Experimental Forest, Puerto Rico. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico and Center for Energy and Environment Research of the University of Puerto Rico, Río Piedras, Puerto Rico. 89 p.

Santana C, E. and S.A. Temple. Breeding biology and diet of red-tailed hawks in Puerto Rico. Biotropica 20(2):151-160.

Wadsworth, F.H. Finding forestry alternatives. American Forests 94 (11-12):36.

*Weaver, P.L. and J.K. Francis [n.d.]. *Hibiscus elatus* Sw. Mahoe Malvacae, Mallow family. SO-ITF-SM-14. United States Department of Agriculture, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 7 p.

*Weaver, P.L. *Guarea guidonia* (L.) Sleumer. American muskwood. Meliaceae, Mahogany family. SO-ITF-SM-17. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 7 p.

*Weaver, P.L. and J.K. Francis. Growth of teak, mahogany, and spanish cedar on St. Croix, U.S. Virgin Islands. Turrialba 38(4):308-317.

*Weaver, P.L., R.A. Birdsey, and C.F. Nicholls. Los recursos forestales de San Vicente, Indias Occidentales. SO-RP-244. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 27 p.

Wiley, J.W. Host selection by the shiny cowbird. The Condor 90(2):289-303.

1989

*Arendt, W.J. and J. Faaborg. Sources of variation in measurements of birds in a Puerto Rican dry forest. Journal of Field Ornithology 60(1):1-11.

Faaborg, J. and W.J. Arendt. Longevity estimates of Puerto Rican birds. North American Bird Bander 14(1):11-13.

*Francis, J.K. *Pterocarpus macrocarpus* Kurz. Burma padauk, pradu. Leguminosae, Legume family. SO-ITF-SM-19. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 4 p.

*Francis, J.K. *Thespesia grandiflora* (DC.) Urban. Maga. Malvaceae, Mallow family. SO-ITF-SM-21. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 4 p.

*Francis, J.K. *Bucida buceras* L. Ucar. Combretaceae, Combretum family. SO-ITF-SM-18. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 4 p.

Johnston, M.H. and P.L. Weaver. Tree growth and stand structure changes in a Puerto Rican tropical forest, 1943-1988. Ecological Society of America Bulletin. p. 159. (abstract).

*Longwood, F.R. Maderas puertorriqueñas: relacionado a su trabajo a máquina, secado y otras relacionadas. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, Río Piedras, Puerto Rico. 87 p.

Lugo, A.E. Using mangroves wisely. Interciencia 14(5):271.

Lugo, A.E. Biosphere reserves in the tropics: an opportunity for integrating wise use and preservation of biotic resources. Pages 53-67 *in* W.P. Gregg, Jr., S.L. Krugman, and J.D. Wood, Jr., editors. Proceedings of the Symposium on Biosphere Reserves, 4th World Wilderness Congress: Worldwide Conservation, September 11-18, 1987, Estes Park. CO. United States Department of the Interior, National Park Service, Atlanta, Georgia, USA.

*Lugo, A.E. and L.B. Ford, editors. Wildlife Management in the Caribbean Islands. Proceedings of the 4th Meeting of Caribbean Foresters, April 5-9, 1988, Dominica. United States Department of Agriculture, Forest Service, Institute of Tropical Forestry and the Caribbean National Forest, Río Piedras, Puerto Rico. 129 p.

Parrotta, J.A. The influence of management practices on the biogeochemical stability of tropical fuelwood plantations. Tropical Ecology 30(1):1-12.

*Scatena, F.N. An introduction to the physiography and history of the Bisley experimental watersheds in the Luquillo Mountains of Puerto Rico. General Technical Report, SO-72. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 22 p.

Wadsworth, F.H., B.R. Parresol, and J.C.F. Colon. Tree increment indicators in a subtropical wet forest. Pages 205-213 *in* Wan Razali Wan Mohd., H.T. Chan, and S. Appanah, editors. Proceedings of the Seminar on Growth and Yield in Tropical Mixed/Moist Forests, June 20-24, 1988, Kuala Lumpur, Malaysia. Forest Research Institute, Kuala Lumpur, Malaysia.

*Weaver, P.L. Taungya plantings in Puerto Rico: assessing the growth of mahogany and maría stands. Journal of Forestry 87 (3):37-41.

*Weaver, P.L. Rare trees in the colorado forest of Puerto Rico's Luquillo Mountains. Natural Areas Journal 9(3):169-173.

*Weaver, P.L. Forest changes after hurricanes in Puerto Rico's Luquillo Mountains. Interciencia 14(4):181-192.

*Weaver, P.L. *Andira inermis* (W.Wright) DC. Cabbage angelin. Leguminosae, Legume family. SO-ITF-SM-20. United States Department of Agriculture, Forest Service, Southern Forest Experiment Station, Institute of Tropical Forestry, New Orleans, Louisiana, USA. 7 p.

*Wunderle, Jr., J. Book review of: Snyder, Noel F.R., J.W. Wiley, and C.B. Kepler. 1987. Skirting the brink of extinction--the Puerto Rican parrot. Ecology 70(2):528.

VERSION EN ESPAÑOL

INVESTIGACIÓN DE PLANTACIONES FORESTALES

John K. Francis
Investigador Forestal

Mahoe, *Hibicus elatus*, es una de las mejores especies exóticas de madera introducida a Puerto Rico. Las plantaciones de mahoe de 6-26 años a través de la isla se han estudiado y evaluado (Francis y Weaver 1988). Originalmente distribuído desde Cuba hasta Jamaica, el mahoe puede crecer en la mayoría de los suelos en áreas donde la lluvia excede 1,500 mm por año. La especie crece rápidamente a una altura de 20 a 30 m y alcanza diámetros comerciables de 0.4 a 0.6 m de 25 a 35 años. Areas basales alrededor de 40 m /ha pueden ser sostenidas con un incremento anual de volumen promedio de 5 a 36 m3/ha.año. Mahoe produce una atractiva madera color metálico-gris, de densidad mediana que seca y corta bien. Tablas para estimar volumen comerciable han sido desarrolladas a base de 50 árboles con diámetros que fluctúan de 15 a 60 cm cortados a través de todo Puerto Rico. Ecuaciones y tablas para obtener volumen de madera comerciable con o sin corteza, peso de troncos comerciables como madera verde y seca, y diámetros de madera pura también se han desarrollado (Francis 1989). Una ecuación "local" para volumen que requiere sólo el conocimiento del diámetro del árbol (D) da el volumen comerciable con corteza (Vwb) en m^3:

$$Vcc = 0.1112 - 0.01312\ D + O.OOO9599\ D^2$$

El Huracán Hugo afectó severamente al Arboretum del Bosque Experimental de Luquillo, incluyendo 70 especies de 0-30 años. Algunas parcelas fueron totalmente desvastadas; la mayoría de ellas sufrieron algún rompimiento y desgarramiento provocado por el viento. Sólo algunas de las parcelas recientemente plantadas escaparon del daño. Toda la instalación fue remedida y clasificados los árboles por el daño. Una visita adicional 6 meses después del huracán fue hecha para determinar la mortalidad de los árboles que quedaron en pie. Trabajando con lo que quedó y con nuevas plantaciones, el área puede ser rehabilitada.

Literatura Citada

Francis, J.K. 1989. Merchantable volume and weights of mahoe in Puerto Rican Plantations. Research Note S0-355. Southern Forest Experiment Station, U.S. Department of Agriculture, Forest Service, New Orleans, LA. 4 p.

Francis, J.K. y P.L. Weaver. 1988. Performance of *Hibiscus elatus* in Puerto Rico. Commonwealth Forestry Review 67(4):327-338.

Institute of Tropical Forestry. [n.d.]. Tropical silvics manual. SO-ITF-1 to 25. Southern Forest Experiment Station, U.S. Department of Agriculture, Forest Service.

U.S. Forest Service. 1990. Silvics of forest trees of the United States. Agricultural Handbook. U.S. Department of Agriculture, Washington, DC. (in press).

ESTUDIOS COOPERATIVOS EN EL MANEJO DE PLANTACIONES DE PINO CARIBAEA

Leon H. Liegel
Especialista en Suelos

Hubo dos logros en relación a la finalización del pasado proyecto US-AID, ID/SCI/E2/06: Relaciones entre sitio y crecimiento de pino caribaea en diversos suelos de Costa Rica, Jamaica, Trinidad, y Venezuela (ver cartas anuales de 1986-87 y previos años). Un manuscrito re-editado fue sometido para publicación como un Reporte Técnico General SO: Relaciones entre sitio y crecimiento de pino caribaea en la cuenca del caribe. Cinco capítulos, presentados como casos de estudio, presentan datos resumidos de crecimiento y rendimiento, así como datos de suelos colectados durante 1983-1985.

Los resultados obtenidos de los proyectos de US-AID fueron presentados en forma de afiche antes de su publicación. Esta exhibición de afiches se llevó a cabo en dos reuniones técnicas: en el Simposio del aniversario de oro del Instituto de Dasonomía Tropical, del 24 al 26 de mayo de 1989 en San Juan, Puerto Rico y en la convención nacional de la Sociedad de Forestales Americanos de 1989, del 4 al 27 de septiembre, en Spokane, WA. La variabilidad de los sitios en los cinco países se muestra en la Tabla 1 (página 2). Las condiciones de los rodales, así como datos de crecimiento y rendimiento, son presentados de manera resumida, respectivamente, en las Tablas 2 y 3 (páginas 3 y 4).

La forma de los árboles fue pobre en todos los países. Jamaica fue el país en donde se presentó el menor porcentaje de la cola de zorro. En la mayoría de las parcelas los árboles produjeron pocos conos por arbol y presentaron escaza evidencia de floración pasada o reciente. Se observó bastante vegetación en el sotobosque en todas las parcelas, con excepción de suelos arenosos en Venezuela, en parcelas que fueron quemadas en los otros países. El mayor incremento medio anual se presentó en Venezuela.

MANUAL DE SILVICULTURA TROPICAL

John K. Francis
Dasónomo

Durante los últimos años hemos estado trabajando en un manual de silvicultura de árboles tropicales. Este manual es similar al que ha publicado el Servicio Forestal de los Estados Unidos para especies de zonas templadas. Para cada especie se prepara una monografía con toda la información disponible. Todas las monografías contienen el mismo formato y los tópicos incluyen la historia de vida de la especie, su crecimiento, los sistemas de manejo y los usos. En muchos ejemplos los autores coleccionan y reportan datos originales para suplementar la información bibliográfica. Además las monografías contienen mapas de distribución de la especie y una foto del arbol en etapa madura. Cada trabajo se publica independientemente en un formato con argollas para facilitar su colección en libretas. Al presente se han publicado monografías para 28 especies y hay aredeor de 30 especies adicionales en preparación. Otras 20 especies de árboles tropicales han sido incluidas en la nueva edición del manual de silvicultura que pronto publicará el Servicio Forestal de los Estados Unidos. Nuestra intención es recoger en un solo volumen todas las monografías de especies tropicales. Además queremos, eventualmente, traducir el volumen al español. La tabla que sigue contiene una lista de las monografías ya publicadas con sus autores.

Especie	Autores	Número de publicación
Anthocephalus chinensis	A.E. Lugo y J. Figueroa	SO-ITF-SM-Ol
Rhizophora mangle	J.A. Jiménez	SO-ITF-SM-02
Laguncularia racemosa	J.A. Jiménez	SO-ITF-SM-03
Avicennia germinans	J.A. Jiménez y A.E. Lugo	SO-ITF-SM-04
Khaya senegalensis	A. Bokkestijn y J.K. Francis	SO-ITF-SM-05
Albizia procera	J.A. Parrotta	SO-ITF-SM-06
Albizia lebbek	J.A. Parrotta	SO-ITF-SM-07
Maesopsis eminii	J.K. Francis	SO-ITF-SM-08
Khaya nyasica	J.K. Francis y A. Bokkestijn	SO-ITF-SM-09
Agathis robusta	J.K. Francis	SO-ITF-SM-10
Araucaria heterophylla	J.K. Francis	SO-ITF-SM-11
Terminalia ivorensis	J.K. Francis	SO-ITF-SM-12
Hernandia sonora	J.K. Francis	SO-ITF-SM-13
Hibiscus elatus	P.L. Weaver y J.K. Francis	SO-ITF-SM-14
Enterolobium cyclocarpum	J.K. Francis	SO-ITF-SM-15
Eucalyptus deglupta	J.K. Francis	SO-ITF-SM-16
Guarea guidonia	P.L. Weaver	SO-ITF-SM-17

Especie	Autores	Número de publicación
Bucida buceras	J.K. Francis	SO-ITF-SM-18
Pterocarpus macrocarpus	J.K. Francis	SO-ITF-SM-19
Andira inermis	P.L. Weaver	SO-ITF-SM-20
Thespesia grandiflora	J.K. Francis	SO-ITF-SM-21
Mammea americana	J.K. Francis	SO-ITF-SM-22
Terminalia catappa	J.K. Francis	SO-ITF-SM-23
Dalbergia sissoo	J.A. Parrotta	SO-ITF-SM-24
Tabebuia donell-smithii	J.K. Francis	SO-ITF-SM-25
Syzygium jambos	J.K. Francis	SO-ITF-SM-26
Hymenaea courbaril	J.K. Francis	SO-ITF-SM-27
Fraxinus uhdei	J.K. Francis	SO-ITF-SM-28

INVESTIGACIÓN Y MANEJO FORESTAL

Peter L. Weaver
Dasónomo

Bosques Naturales

De 14 a 49 años después del huracán de 1932, San Ciprián, se observaron cambios en siete parcelas permanentes en el bosque de colorado de las montañas de Luquillo (Weaver 1989a). Estos fueron: 1) tasas de reclutamiento y mortalidad de 20 tallos por hectárea por año, o sea, un flujo de 1.1% por año del número original de tallos; 2) mayores diámetros y alturas, indicando crecimiento; 3) una disminución en el número de tallos de la clase de coronas intermedias y aumento de tallos en la clase de coronas suprimidas, con un creciente "cerramiento" gradual del bosque; 4) un aumento de 3.9% del peso específico de los tallos de dicotiledóneas, lo cual refleja la declinación de especies secundarias y la dominancia gradual de especies primarias; 5) una disminución del número total de especies en todas las parcelas, en combinación con una tendencia hacia la convergencia del número de especies en parcelas individuales; 6) un aumento en la similaridad de las parcelas en 1981 con respecto a la década de los 40 para dos tercios de las comparaciones entre parcelas; 7) una disminución de 35% en el incremento del diámetro de los árboles sobrevivientes; y 8) un aumento promedio de la biomasa leñosa aérea que en promedio fue de 0.67 t/ha.año.

Dos estudios independientes de la vegetación arborescente en el bosque colorado en las montañas de Luquillo de Puerto Rico revelaron 15 especies de árboles encontradas en la lista local de especies raras y en peligro de extinción (Weaver 1989b). Siete parcelas permanentes establecidas en 1946 proveyeron una oportunidad para evaluar tendencias en los números de especies raras e individuos durante los años. Setenta y cinco parcelas temporeras, variando en elevación, aspecto y topografía, proveyeron información en distribuciones espaciales según gradientes ambientales.

Plantaciones

Se inicaron siembras "taungya" durante la década de 1930 en Puerto Rico cuando se establecieron maría (*Calophyllum calaba*) y caoba (*Swietenia macrophylla*) en el Bosque Experimental de Luquillo y en el Bosque Río Abajo del Estado Libre Asociado de Puerto Rico (Weaver 1989c). Los agricultores sembraron las plántulas entre cultivos — usualmente maíz, frijoles, bananos, plátanos y otras cosechas. Mediciones hechas temprano en la decada de 1980 proveyeron estimados del incremento promedio anual de volumen (MAI) y del incremento corriente anual (CAI), ambos en metros cúbicos por hectárea por año.

Las MAI para caoba sólo en Luquillo y Río Abajo fueron 7.6 y 3.8 durante el período de medición. Las CAI durante los últimos dos años fueron 12.1 y 7.8, respectivamente. Las MAI para maría sólo en Luquillo y Río Abajo fueron 4.8 y 3.2 durante el período de medición. Las CAI durante los últimos dos años fueron 5.0 y 9.4, respectivamente. Se concluyó que el incremento de las parcelas fue satisfactorio y que representaba un incremento que se podía esperar en varios sitios tropicales donde las siembras se desarrollan con un mínimo de mantenimiento.

Se estudió el incrementro de caoba (*Swietenia* spp.) y teca (*Tectona grandis*) y el comportamiento de teca y procedencias de Cedro español (*Cedrela* sp.) localizados en las zonas de vida seco subtropical y húmedo subtropical

en Santa Cruz, Islas Vírgenes de los Estados Unidos (Weaver y Francis 1989). El híbrido de caoba (*S. macrophylla* x *S. mahagoni*) de Santa Cruz tenía la mejor forma y tasa de incremento de todas las especies probadas. El incremento promedio anual de los fustes del híbrido de caoba fue 8.1 m³/ha.año, el incremento promedio de diámetro fue 0.78 cm/año y el incremento promedio anual de altura fue 0.47 m/año. Datos comparables para teca de 30 años fueron 3.9 m³/ha.año, 0.76 cm/año, y 0.5 m/año, respectivamente. La caoba de las Indias Occidentales (*S. mahagoni*), después de 25 años, promedio 6.0 m³/ha.año, 0.86 cm/año, y 0.44 m/año, respectivamente. El crecimiento de caoba de la costa del Pacífico (*S. humilis*) y de las procedencias de Cedro español fue menos satisfactorio.

Planeo y Manejo Forestal - Grenada

Se escribió un informe técnico de Grenada delineando su ambiente, historia forestal, planes de manejo forestal y recomendaciones para futuras actividades forestales durante una visita a Grenada patrocinada por la FAO (Weaver 1989e). Los ambiciosos planes forestales de manejo cubren Grand Etang, Mt. St. Catherine, Levera, Carriacou, otros terrenos de la reserva forestal, así como las tierras marginales en las fincas modelos. Se discutieron los mejores puntos de planificación para manejo (agua, vida silvestre, recreo, madera, investigaciones, uso de terrenos forestales y la política y su cumplimiento).

Literatura Citada

Weaver, P.L. 1988. *Guarea guidonia* (L.) Sleumer, American muskwood. SO-ITF-SM-17. Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 7 p.

Weaver, P.L. 1989a. Forest changes after hurricanes in Puerto Rico's Luquillo Mountains. Interciencia 14(4):181-192.

Weaver, P.L. 1989b. Rare trees in the Colorado Forest of Puerto Rico's Luquillo Mountains. Natural Areas Journal 9(3):169-173.

Weaver, P.L. 1989c. Taungya plantings in Puerto Rico. Journal of Forestry 87(3):37-41.

Weaver, P.L. 1989d. *Andira inermis* (W. Wright) H.B.K., Cabbage angelin. SO-ITF-SM-20. Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 7 p.

Weaver, P.L. 1989e. Forestry development Grenada - Technical Report: forestry planning and management activities. FO:TCP/GRN/8851. St. George's, Grenada. 112 p.

Weaver, P.L. y J.K. Francis. 1988. *Hibiscus elatus* Sw. mahoe. SO-ITF-SM-14. Institute of Tropical Forestry, Southern Forest Experiment Station, Río Piedras, Puerto Rico. 7 p.

Weaver, P.L. y J.K. Francis. 1989. Growth of teak, mahogany and Spanish cedar on St. Croix, U.S. Virgin Islands. Turrialba 38(4):308-317.

ESTUDIOS ECOLOGICOS

Ariel E. Lugo
Ecólogo

Se evaluaron seis interrogantes sobre el tópico de la diversidad de especies tropicales, las cuales han eludido contestación (Lugo 1988a). Este trabajo tenía el próposito de estimular la investigación en el tópico de la diversidad de especies durante la década de los trópicos del programa de la Unión Internacional de Sociedades de Ciencias Biológicas. Las preguntas son: (1) ¿Cómo se mide la diversidad de especies? (2) ¿Por qué hay tanta diversidad de especies en los trópicos? (3) ¿Cómo se mantiene la alta diversidad de especies? (4) ¿Qué función ecológica, sí alguna, tiene la alta diversidad de especies? (5) ¿Cómo se beneficia el ser humano de la alta diversidad de especies? (6) ¿Cómo está cambiando la diversidad de especies?

La discusión de la primera pregunta enfatiza la importancia de inventarios cuantitativos de especies y el uso de sistemas de información geográfica. Se discute que enfoques evolucionarios y ecofisiológicos a las preguntas 2 y 3 deben de articularse claramente y no confundirse. Además, es necesario poner más énfasis en la función de factores ambientales, particularmente los factores de tensión y en la definición de términos de uso común como lo es el término "recurso". La evolución y el mantenimiento de una alta riqueza de especies son dos temas distintos que rutinariamente se confunden y se mezclan en la literatura. En el trabajo propongo un modelo para explicar el mantenimiento de una alta diversidad de especies. Con ese modelo se discute la pregunta 4 y se relaciona la función ecológica de la alta diversidad de especies a la eficiencia en el uso de recursos especialmente los nutrientes. Al discutir la pregunta 5 se nota que la interacción con, y dependencia del ser humano de la alta diversidad de especies en el trópico tienen una larga historia. De hecho, bosques que antes se creían vírgenes ahora se sabe que han sido intervenidos y manipulados por seres humanos. La resiliencia de los bosques tropicales vis-a-vis la presente intervención masiva del ser humano en dichas regiones se discuten en la pregunta 6. Es obvio que para mantener la alta diversidad de especies en los trópicos será necesario mejorar las técnicas de manejo de bosques, poner más énfasis en la rehabilitación de terrenos degradados, en los usos sensibles de bosques secundarios y plantaciones, y prestar más atención a las necesidades del ser humano.

El problema de la rehabilitación de bosques tropicales se discutió en el volúmen del 30 aniversario de la revista "Environment" (Lugo 1988b). La sucesión en bosques degradados puede tomar muchas trayectorias (Fig. 1, página 9). El manejo adecuado del bosque degradado puede resultar en su rehabilitación para usos del ser humano. Algunas estrategias para la rehabilitación de bosques se presentan en el Cuadro 1 (página 10). Un conjunto de datos demuestran que numerosas especies de árboles nativos crecen sin problemas en el interior de plantaciones de árboles exóticos. Estas plantaciones se pueden utilizar para rehabilitar sitios degradados y establecer allí bosques con especies nativas (Fig. 2, página 11).

También resumí de la literatura sugerencias para el manejo sabio de los bosques latinoamericanos (Tabla 1, página 11; Lugo 1988c). Las estrategias de manejo enfocan el uso de los bosques para suplir energía y otros productos y servicios.

Hemos editado un libro sobre el manejo ecológico de las tierras tropicales dentro del marco del desarrollo sostenido de la región (Lugo et al. 1987). El libro contiene módulos sobre los siguientes temas: áreas de protección, producción de madera, cosecha de bosques, plantaciones, agrosilvicultura, sistema de pastoreo y acuacultura. Los usos de terrenos se presentan en el contexto de las zonas de vida de Holdridge (Fig. 3, página 12).

Además publiqué un artículo sobre las estrategias de conservación en los trópicos (Lugo 1989a). En él, sugerí nueve elementos para una ética de conservación. Estos son: (1) centralizar esfuerzos en las necesidades humanas a corto y largo plazo, (2) enmarcar la actividad en el contexto de los niveles éticos y humanitarios más altos, (3) utilizar la mejor información científica disponible, (4) integrar ideas de preservación con las ideas de conservación (uso sabio) y rehabilitación de ecosistemas, (5) darle prioridad a la educación pública, (6) confiar en que una sociedad bien informada tomará las decisiones correctas sobre el uso y manejo de los recursos naturales, (7) trabajar estrechamente con las autoridades locales, el gobierno y la gente del país, (8) fortalecer las instituciones dedicadas a la investigación, educación, conservación y manejo de los recursos naturales, y (9) suprimir mitos y emocionalismos irracionales.

Finalmente, y en conmemoración del 500 aniversario del descubrimiento de Puerto Rico, preparé un programa de diapositivas sobre los bosques del Caribe según los vió Cristobal Colón durante su segundo viaje (Lugo 1989b). Edité también tres números de la nueva revista Acta Científica, la publicación oficial de la Asociación de Maestros de Ciencia de Puerto Rico. Y edité las actas de la cuarta reunión de los dasónomos del Caribe. El Cuadro 2 (página 13) contiene el editorial de esta publicación, la cual resume la condición de la vida silvestre en el Caribe.

Literatura Citada

Lugo, A. 1988a. Diversity of tropical species: questions that elude answers. Biology International, Special issue 19, 37 p.

Lugo, A.E. 1988b. The future of the forest: ecosystem rehabilitation in the tropics. Environment 30(7):16-20 and 41-45.

Lugo, A.E. 1988c. Uso de las zonas boscosas de América Latina tropical. Interciencia 13(6):288-295.

Lugo, A.E. 1989a. Biosphere reserves in the tropics: an opportunity for integrating wise use and preservation of biotic resources. Páginas 53-67 *en* W.P. Gregg, S.L. Krugman y J.D. Wood (editores). Fourth World Wilderness Congress: Worldwide Conservation. Proceedings of the Symposium on Biosphere Reserves. USDI, National Park Service, Science Publications Office, Atlanta, Ga.

Lugo, A.E. 1989b. Forest lands in Puerto Rico and the Caribbean 500 years after their discovery by Cristoforo Colombo. Narrative, 80 slides, and appendix. 16 p.

Lugo, A.E., J.R. Clark y R.D. Child (editores). 1988. Ecological development in the humid tropics: guidelines for planners. Winrock International, Institute for Agricultural Development, Morrilton, Arkansas. 362 p.

INVESTIGACIONES DE LA FAUNA SILVESTRE

Joseph M. Wunderle
Biólogo de Vida Silvestre

Durante el año pasado, diferentes estudios de vida silvestre se han iniciado y otros continuado. Dos de los estudios están directamente relacionados con nuestros esfuerzos para recuperar la cotorra de Puerto Rico, dos proyectos enfocan los efectos de los huracanes en las poblaciones de aves en los bosques y otro proyecto examina el uso del hábitat y la biología poblacional de un ave migratoria de Norte América que pasa el invierno en Puerto Rico. Estos proyectos se detallan a continuación .

Estudio Fenológico de Plantas que Pruducen Frutas y Semillas Usadas por la Cotorra de Puerto Rico en el Bosque de Palo Colorado

Este estudio, basado en tres veredas fenológicas con aproximadamente cien árboles y bejucos marcados en cada vereda, ya está en su tercer año. Este estudio ha probado ser particularmente importante en determinar el impacto del Huracán Hugo sobre las fuentes tradicionales de alimento de la cotorra. Además el estudio nos permitirá examinar el patrón anual y de cada año de la disponibilidad de alimento para la cotorra en un esfuerzo para entender mejor el uso del hábitat por la cotorra.

El Efecto de las Condiciones de Crianza en el Desarrollo de la Habilidad del Manejo de la Comida en Cotorras de la Hispañiola

Un estudio de aviario sobre el comportamiento alimenticio de la cotorra se ha iniciado en colaboración con la Dra. Marcia Wilson (Servicio de Pesca y Vida Silvestre de los Estados Unidos) en un esfuerzo para determinar la edad óptima para liberar las cotorras criadas en cautiverio. Las cotorras juveniles no poseen inicialmente las habilidades alimenticias de los adultos, y sólo luego de mucha experiencia obtienen estas habilidades. Se sabe que la ineptitud de las aves jóvenes para alimentarse contribuye a incrementar la mortandad en varias especies de aves, y parece ser particularmente importante en las cotorras. Por lo tanto, sería valioso liberar las cotorras criadas en cautiverio a una edad en que hayan adquirido la habilidad alimenticia de los adultos. El estudio de aviario no se ha completado aún, pero una revisión mayor de las habilidades alimenticias de las aves jóvenes sí se ha completado.

Los Efectos de los Huracanes en las Poblaciones de Aves Terrestres

Los huracanes son uno de los factores de disturbio de mayor importancia en muchos bosques tropicales. Estudios sobre el impacto de los huracanes en los bosques y principalmente en su vida silvestre, ayudará a identificar especies que estén en mayor riesgo, a la misma vez que nos ayudará a designar estrategias de manejo para especies amenazadas y en peligro de extinción.

En colaboración con el Dr. Robert Waide y la Dra. D. Jean Lodge (Centro de Estudios Energéticos y Ambientales) estudié el efecto del Huracán Gilbert en la avifauna de Jamaica. Este huracán azotó Jamaica el 12 y 13 de septiembre de 1988 con vientos sostenidos de 126 mph que arrasaron nuestros diez sitios de estudios establecidos en diciembre de 1987, antes de la tormenta. Regresamos a estos diez sitios cuatro meses despues de la tormenta y repetimos nuestros métodos básicos: redes, conteos en puntos con radio fijo y medidas de vegetación. Tres sitios montañosos (bosque de pinos, de

nube y cafetal) mostraron una baja significativa en el número total de individuos y de especies, mientras que dos sitios de llanura (bosque húmedo de piedra caliza y manglares) mostraron un aumento significativo. Los restantes sitios de llanura no mostraron cambio. Las especies que mostraron la mayor baja fueron aquellas regiones montañosas que dependían más en plantas para su alimentación (nectívoros, fructívoros y aves que comen semillas), mientras que los insectívoros casi no sufrieron cambio. Por lo tanto, el efecto de la tormenta a corto plazo fue complejo, dependiendo del hábitat y su uso, la elevación y a veces de la misma comunidad de aves terrestres.

Uso del Hábitat y Biología Poblacional de la Reinita Azul Invernando en Puerto Rico

En años recientes, biólogos han mostrado una considerable preocupación acerca del estado de las aves migratorias de Norte América que pasan el invierno en los trópicos. Parte de esta preocupación se debe a la masiva destrucción de las áreas de invernación de estas especies migratorias. A la luz de esta preocupación he iniciado una investigación sobre la Reinita Azul, una especie indicadora para el Bosque Experimental de Luquillo. Hasta ahora este estudio ha documentado una segregación sexual del hábitat y descubierto diferencias en el uso del hábitat en diferentes tipos de bosques. Este estudio envuelve individuos anillados y proveerá información sobre supervivencia en diferentes hábitats y nos ayudará a identificar áreas críticas de invernación para esta especie.

OTRAS INVESTIGACIONES DE LA FAUNA SILVESTRE

Wayne J. Arendt
Biólogo de Vida Silvestre

Monografía del Zorzal Pardo

Un análisis de 210 especies de aves terrestres del Caribe (desde Columbiformes hasta Paseriformes, excepto los Falconiformes) demuestra que el Zorzal Pardo (*Margarops fuscatus*) es el mejor representante de las tres especies de aves "supertramps" en la región, de acuerdo con el concepto de especies "supertramps" de Diamond (1974 [Tabla 1, página 17]). Las especies "supertramps" poseen las siguientes características: (a) son colonizadores excelentes pero pobres competidores dentro de las comunidades de aves con alta diversidad; (b) su alto potencial reproductivo envuelve un apareamiento rápido y extenso, y una camada grande o múltiple en cada temporada; y (c) típicamente tienen la habilidad de hacer cambios drásticos en su distribución altitudinal, habitat, dieta, y formas de alimentación. Estas habilidades le permiten, tanto un establecimiento y crecimiento exitoso a las poblaciones colonizadoras que llegan a una isla, como un aumento en densidad en las poblaciones ya establecidas.

El Zorzal Pardo ha demostrado ser un residente permanente (reproductor) en 82 de las 177 islas que componen las Indias Occidentales, las cuales son pequeñas, de poca diversidad, o islas grandes con comunidades compuestas de pocas especies de aves (ej., el bosque pluvial de Puerto Rico; Fig. 1, página 18).

Investigaciones sobre la ecología del Zorzal Pardo durante los pasados 12 años han demostrado lo siguiente: (a) posee una gran capacidad de dispersión y una alta habilidad en permanecer cerca de su hogar; (b) se le considera como generalista en el uso del habitat, encontrándosele en la vegetación costera, en los bosques secos y en bosques lluviosos en los picos de las montañas más altas; (c) es omnívoro; (d) demuestra una gran variedad (en términos espacio-temporales) en el uso de zonas y maneras de alimentación; (e) logra alcanzar altas densidades poblacionales; (f) presenta poco dimorfismo sexual; y (g) demuestra variaciones morfológicas entre poblaciones alopátricas, tanto dentro y como entre las islas.

Monitoreo a Largo Plazo de las Aves de Guánica

Longevidad

Interpretando los resultados de los datos de supervivencia de 11 años de un área de anillaje continental (Panamá), Karr *et al.* (en imprenta) argumentan sobre la creencia tradicional de que las aves tropicales viven más tiempo que las aves de zonas templadas. Históricamente se pensaba que las aves tropicales sobrepasaban a sus contrapartes del norte en términos de una mayor supervivencia de los adultos. El tiempo de vida promedio de las aves paserinas migratorias de América del Norte es de 1-3 años, aunque algunos individuos pueden tener una longevidad de 5-10 años (Klimkiewicz *et al.* 1983, Klimkiewicz y Futcher 1987). Sin embargo, los individuos de la mayoría de las especies de aves tropicales que no migran pueden vivir de 1-2 décadas, principalmente debido a la "estabilidad" (ahora dudosa) del ambiente tropical. Karr y sus colegas opinan que el tiempo de vida de las aves tropicales es comparable con el de las especies norteñas. Mientras que los cambios drásticos en temperatura y los regiones de la migración disminuyen la longevidad de las especies del norte, factores tales como la depredación en los nidos, la alta depredación de

adultos por especies de rapiña y disturbios ambientales (ej., sequías y huracanes) son las causas principales de mortalidad de las aves tropicales.

Para comparar los resultados de Karr *et al.* en un área continental con otros realizados en comunidades de aves isleñas, se están analizando los datos de 17 años de supervivencia de aves residentes en nuestra área tradicional de anillaje en el Bosque de Guánica, al suroeste de Puerto Rico (Tabla 2, página 19). Aunque es demasiado temprano para interpretar todos los datos de forma decisiva, las observaciones preliminares demuestran que por lo menos algunos de los individuos de aves residentes en el Bosque de Guánica han vivido un largo tiempo. Recientemente Faaborg y Arendt (1989a) publicaron un resumen de las marcas de longevidad para 21 especies de aves del Bosque de Guánica. Algunos individuos en 12 de las 21 especies han sobrevivido por más de 5 años, aunque algunos han alcanzado 11 y 14 años de edad. Estos estimados de longevidad resultan impresionantes porque el 67% de la muestra contenía 50 individuos o menos, y la proporción de regreso promedio para las 21 especies fue de 20%, con bajas proporciones de regreso en 13 especies.

Disminución Poblacional

Durante las pasadas dos décadas se han publicado cerca de dos docenas de artículos sobre la disminución poblacional de aves migratorias de América del Norte (Aldrich y Robins 1970, Holmes y Sherry 1986). Recientemente Faaborg y Arendt (1989b) analizaron las fluctuaciones poblacionales de las reinitas migratorias de América del Norte en el Bosque de Guánica durante 15 años, ya que este grupo de aves representa una gran proporción de las aves atrapadas en el área tradicional de anillaje en este bosque. Los resultados demuestran una disminución continua en el número de individuos migratorios residentes (estacionales) a través del periodo de estudio. Se debe enfatizar que el tamaño de la muestra fue pequeña en cada año y que algunos factores ecológicos pudieron tener su efecto (ej., individuos moviéndose dentro y fuera del bosque y entre los habitats, según ocurrían cambios ecológicos y ambientales).

Morfometría de las Aves de Guánica

Durante 15 años de trabajo en el área tradicional de anillaje en el Bosque de Guánica se realizaron más de 2,000 capturas de 40 especies de aves pertenecientes a 14 familias (Arendt y Faaborg 1989). Se utilizó el peso y el largo del ala de 246 individuos en 25 especies de aves capturadas y recapturadas 612 veces para demostrar que: (1) las variaciones temporales en individuos y entre diferentes individuos son mínimas cuando se toman las medidas en la misma época del año; (2) los instrumentos para medir que se usan ampliamente en el campo son precisos; (3) las técnicas de muestreo pueden ser comparables; (4) el efecto del investigador, ya sea midiendo solo o trabajando en grupos, es mínimo cuando se comparan muestras grandes y aun pequeñas. Las variaciones diurnas y estacionales, cuando se observan, se atribuyen a fluctuaciones estacionales en los recursos alimenticios, desgaste del plumaje, actividades reproductivas, e incremento en peso debido al alimento ingerido.

Estos datos enfatizan que el tiempo para medir las aves es crítico cuando se comparan medidas morfológicas entre estudios diferentes. Las comparaciones de medidas entre diferentes estaciones del año, o las comparaciones de medidas tomadas durante todo el año con otras tomadas en un corto periodo de tiempo, pueden reflejar diferencias sin significado biológico alguno.

Para complementar los estudios recientes sobre las biología reproductiva y el uso de habitats por la Garza Ganadera en la isla de Montserrate (Arendt y Arendt 1988). Se reportó la expansión del área de *Bubulcus ibis* en la Cuenca del Caribe (Arendt 1988).

Se reportó por primera vez la presencia de la Garza Ganadera en el Caribe en la isla de Providencia en el 1933. No se reportó su presencia en la región hasta el 1944, cuando se observó un individuo en la isla de Aruba, en las Antillas Holandesas del Sur. Para el 1957, la Garza Ganadera anidó de manera exitosa en Cuba y en la isla de Santa Cruz. Al presente, esta especie puede encontrarse en más de 50 de las islas grandes a través de la Cuenca del Caribe.

La Garza Ganadera demuestra altas tendencias de dispersión y migración. Las primeras Garzas Ganaderas que llegaron a las islas del Caribe fueron probablemente individuos migratorios. Su rápida expansión del rango en el Caribe y a través del Neotrópico fue simultáneo con el aumento en la crianza de ganado e intensas prácticas agrícolas, tales como la irrigación y el uso del fuego. También se le atribuye el éxito de la Garza Ganadera en la región del Caribe a su alta taza reproductiva, su crecimiento poblacional de forma exponencial, extensas temporadas de reproducción y la escasez de depredadores.

Literatura Citada

Aldrich, J.W. y C.S. Robbins. 1970. Changing abundance of migratory birds in North America. Smithsonian Contributions in Zoology 26:17-26.

Arendt, W.J. 1988. Range expansion of the Cattle Egret (*Bubulcus ibis*) in the Greater Caribbean Basin. Colonial Waterbirds 11(2):252-262.

Arendt, W.J. y A.I. Arendt. 1988. Aspects of the breeding biology of the Cattle Egret (*Bubulcus ibis*) in Montserrat, West Indies, and its impact on nest vegetation. Colonial Waterbirds 11(1):72-84.

Arendt, W.J. y J. Faaborg. 1989. Sources of variation in measurements of birds in a Puerto Rican dry forest. Journal of Field Ornithology 60(1):1-11.

Diamond, J.M. 1974. Colonization of exploded volcanic islands by birds: the supertramp strategy. Science 184:803-806.

Faaborg, J. y W.J. Arendt. 1989a. Longevity estimates of Puerto Rican Birds. North American Bird Bander 14:11- 13.

Faaborg, J. y W.J. Arendt. 1989b. Long-term declines in winter resident warblers in a Puerto Rican dry forest. American Birds 43(4):1226-1230.

Holmes, R.W. and T.W. Sherry. 1986. Bird community dynamics in a temperate deciduous forest: long-term trends at Hubbard Brook. Ecological Monographs 56:201-220.

Klimkiewicz, M.K., R.B. Clapp y A.G. Futcher. 1983. Longevity records of North American birds: Remizidae through Parulinae. Journal of Field Ornithology 54:287-294.

Klimkiewicz, M.K. y A.G. Futcher. 1987. Longevity records of North American birds: Coerebinae through . Journal of Field Ornithology 58:318-333.

INVESTIGACIONES EN DESCOMPOSICION DE MADERA Y ENTOMOLOGIA FORESTAL

Juan A. Torres
Biologo de Vida Silvestre

Se han conducido investigaciones sobre los invertebrados que participan en la descomposición de Palo Colorado (*Cyrilla racemiflora*) Guaba, (*Inga vera*), Motillo (*Sloanea berteriana*). En Palo Colorado los descomponedores más importantes fueron larvas de la familia Cerambycidae (Coleóptera). Las termitas tienen un rol menor en la descomposición de la madera de Palo Colorado en el Bosque Experimental de Luquillo. Sin embargo, troncos de Palo Colorado transplantados al Bosque Seco de Guánica señalan que las termitas son bien importantes en la descomposición de la madera en los bosques secos. Las larvas de los cerambícidos son responsables de la formación de cavidades en Palo Colorado. Estas larvas pueden penetrar con facilidad la madera de Palo Colorado y permiten la penetración de hongos que ayudan en la creación de las cavidades. La descomposición de los troncos de Guaba y Motillo parece que ocurre más rápido que la de Palo Colorado en el Bosque de Luquillo. Guaba y Motillo son fácilmente atacados por los descortizadores de madera (Scolytidae), escarabajos de la familia Platypodidae, termitas, cerambícidos y larvas de dípteros. La actividad de los cerambícidos facilita la entrada de las larvas de dípteros al interior de la madera.

La comunidad de los invertebrados que participa en la descomposición de la madera ha sido observada en diferentes etapas del proceso de descomposición en Palo Colorado. Esta información se está coleccionando para la Guaba y el Motillo. También la distribución de nutrientes en las etápas de descomposición y en las diferentes áreas radiales del tronco ha sido analizada. Los árboles de Palo Colorado tienen una tendencia a extraer nutrientes de sus propias partes muertas a través del desarrollo de raíces adventicias. Además, puede desarrollar raíces en cualquier dirección hacia bromelias y otros árboles de Palo Colorado.

Durante este año comencé un proyecto de investigación en colaboración con el Dr. Thomas Atkinson de la Universidad de la Florida para estudiar la sistemática de las familias Scolytidae y Platypodidae en Puerto Rico. También daremos énfasis a las relaciones insecto-huésped y los miembros de estas familias que atacan bejucos y semillas. He encontrado que las semillas de Tamarindo (*Tamarindus indica*), María (*Calophyllum brasiliense*), Pomarrosa (*Eugenia jambos*), Palma de Sierra (*Prestoea montana*) y Jácana (*Pouteria multiflora*) pueden sufrir gran daño debido a las actividades de estos insectos.

Publiqué un trabajo sobre los efectos de los huracanes en la migración de insectos (Torres 1988) y otro sobre las hormigas cultivadoras de hongos (Torres 1989). Una de estas hormigas es muy importante en la dispersión de semillas en el Bosque Seco de Guánica. Además, un trabajo sobre los efectos ecológicos, toxicológicos y agrícolas de la hormiga brava introducida (*Solenopsis invicta*) pronto aparecerá en el Journal of Agriculture of the University of Puerto Rico.

Estoy resumiendo datos sobre alrededor de 200 trabajos que se han publicado sobre los insectos en el Bosque Experimental de Luquillo. En colaboración con Roy Snelling del Museo de Historia Natural de los Angeles estoy conduciendo un trabajo sobre la sistemática de las

hormigas de Puerto Rico. Cerca de 13 nuevas especies son reportadas para Puerto Rico. También en colaboración con Daniel Simberloff de la Universidad Estatal de la Florida estoy preparando un trabajo sobre la biogeografía de las hormigas en las islas que bordean a Puerto Rico.

Literatura Citada

Torres, J.A. 1988. Tropical cyclones effects on insect colonization and abundance in Puerto Rico. Acta Científica 2:40-44.

Torres, J.A. 1989. The status of the fungi-grower ants (Hymenoptera: Formicidae) in Puerto Rico and adjacent islands. Journal of Agriculture, University of Puerto Rico 73(4):401-403.

Torres, J.A. Efectos ecológicos, toxicológicos y agrícolas de la hormiga Brasilena, *Solenopsis invicta.* Journal of Agriculture, University of Puerto Rico (en imprenta).

MANEJO DE CUENCAS HIDROGRAFICAS

F.N. Scatena
Hidrólogo

El año fiscal 1989 fue un año de mucha actividad y productividad en los estudios de las cuencas hidrográficas en el Instituto de Dasonomía Tropical. Entre las actividades principales se encuentran el monitoreo ambiental, estudios de biomasa y la reconstrucción de la infraestructura de las cuencas de Bisley después del Huracán Hugo.

Desde la colonización europea hace 490 años, el área de las cuencas se exploró en busca de metales preciosos, se cultivó y se utilizó como explotación forestal selectiva (Scatena 1989). La transformación más rápida en el paisaje ocurrió a finales del siglo 19 y principios del siglo 20. Durante este período, las cuencas permanecieron arboladas; pero se cultivó café, hubo corte selectivo de árboles y fue impactada por tres huracanes mayores. En los días del 17 al 18 de septiembre de 1989, el Huracán Hugo pasó por la región este de Puerto Rico y las cuencas recibieron el impacto directo de un huracán por cuarta vez en los pasados 100 años.

El Instituto continúa teniendo un programa activo de voluntarios y de investigación colaborativa en las cuencas. Estudiantes e investigadores de Asia hasta Alaska han visitado y trabajado en las cuencas de Bisley. Uno de los proyectos de investigación más ambicioso e integrado en este año ha sido los estudios de biomasa y de suelos hechos en colaboración con la Universidad de Yale y la Universidad de Pennsylvania. Dos transectos de 32 m x 32 m fueron cartografeados y muestreados para biomasa de vegetación, suelos, raíces y población de fauna en los meses antes de junio 1989. En junio ambos transectos fueron limpiados de vegetación con la asistencia del personal del Bosque Nacional del Caribe. Arboles previamente seleccionados fueron muestreados para biomasa y se comenzaron una serie de estudios detallados sobre cambios en los nutrientes de suelos y la biomasa en los subsuelos.

Literatura Citada

Scatena, F. N. 1989. An Introduction to the physiography and history of the Bisley Watersheds in the Luquillo Mountains of Puerto Rico. U.S.D.A. Forest Service, Southern Forest Experiment Station General Technical Report 50-72. 22 pages.

ESTUDIOS ESPECIALES

Frank H. Wadsworth
Dasónomo

El trabajo de esta sección se ha convertido mayormente en la transferencia de la tecnología forestal que resulta de los estudios del Instituto y de otras fuentes del trópico. La primera prioridad ha sido la terminación del texto del libro técnico, Producción forestal para América tropical, un proyecto de varios años. Como el texto en sí fue casi terminado hace dos años, lo que queda son los detalles de la presentación de las tablas, las ilustraciones, el glosario, y un índice para la bibliografía . Un evento reciente fue una sesión en Nueva Orleans con Susan Branham, la editora.

La producción del texto para "Noticias ISTF" el noticiero trimestral bilingue de la Sociedad Internacional de Forestales Tropicales fue continuado. Este trabajo resulta de un repaso y resumen de artículos selectos de más de cien revistas y todas las otras publicaciones recibidas en la biblioteca del Instituto. Unas 56 páginas del texto en imprenta fueron producidas en cada idioma (español e inglés), con descripciones de 114 artículos, extractos, anuncios y descripciones de 78 publicaciones de mayor importancia sobre el manejo y utilización de los bosques tropicales. Un cuestionario con 633 respuestas trajo una reacción favorable sobre el noticiero de 9 de cada 10 contestaciones.

Para fomentar la ISTF visité a Brazil, Paraguay, Argentina, Bolivia, Venezuela, Costa Rica, Honduras y Guatemala para determinar como la Sociedad podría ser más útil al personal técnico de la región. Las audiencias en total alcanzaron a más de 750 y produjeron más de 25 sugerencias constructivas para la Sociedad. Durante las visitas también se presentaron las perspectivas de unas investigaciones adicionales sobre la productividad potencial de los bosques secundarios tropicales. Este asunto resultó ser muy popular y produjo mucha participación de las audiencias.

Como consejero del "Eastern Caribbean Natural Areas Management Program" completé un plan silvicultural para los bosques montanos de la isla de Dominica y también se presentaron recomendaciones para el desarrollo del Parque Nacional de la Montaña Sage, en las Islas Vírgenes Británicas. Se lograron unas disposiciones de fondos para comenzar un inventario de las plantas en peligro de extinción en las Antillas Menores.

Como miembro de un grupo internacional de consejeros para el "International Tropical Timber Organization" presenté recomendaciones para el comité de manejo forestal. Fueron adoptadas como base para el programa actual de la agencia. Fui también el representante de los Estados Unidos en una misión del ITTO a Sarawak, Malaysia, para determinar la prolongación de las prácticas forestales de ese país. El proyecto se completará en 1990.

El Instituto recomendó al Grupo de Estudios de Silvicultura de la Comisión Forestal Norteamericana de la FAO un taller sobre métodos de investigación y fue aprobado. Los planes preliminares fueron completados en una reunión en Victoria, Canadá. La actividad se planea para el otoño del 1990 en el sur de México.

El Instituto proveyó consejo técnico para varias reuniones de significado nacional sobre deforestación tropical y el uso de la limitación de importaciones como método para eliminarla.

Estas reuniones fueron patrocinadas por el "Rainforest Alliance", la "International Hardwood Products Association" y el "Smithsonian Institution". En las dos reuniones salieron a la luz los riesgos de los embargos contra la importación de madera tropical y también otros métodos para producir incentivos para el mejor cuido de los bosques.

El proyecto también proveyó respaldo técnico para el Servicio Forestal de Puerto Rico, ofreciendo un día de la semana para consejo. El tema principal es la preparación de planes comprensivos de manejo forestal para cada uno de los 14 Bosques Estatales. Los oficiales de cada uno de los bosques contribuyeron con opiniones sobre políticas y procedimientos. Se ha empezado la acumulación de la información básica para los varios planes. Otro proyecto patrocina la restauración de árboles en las ciudades después del Huracán Hugo. Esto envuelve la coordinación de la producción de los viveros forestales, la selección de especies y la promoción de la siembra. Una ponencia sobre las plantaciones forestales del Bosque Estatal de Guánica fue presentado en un simposio de la Universidad de Puerto Rico.

Al Bosque Nacional "Caribe" se ofreció el servicio de repaso de los documentos del plan de manejo enmendado, consejo sobre el centro de visitas "El Portal del Yunque" bajo estudio, comentarios sobre los planes para cuidar la cotorra puertorriqueña que está en peligro de extinción, y el liderato para un grupo técnico en la preparación de un plan de demostración de la producción forestal dentro del Bosque Nacional. Una ponencia sobre la historia de 50 años de la participación del Instituto en el manejo del Bosque Nacional fue presentado durante la ceremonia del aniversario.

Hace 37 años se ofreció al "Nature Team", un grupo de jóvenes de 16 hasta 18 años de edad que adiestran a los Niños Escuchas sobre la conservación en el campamento de verano de Guajataca. Esto requiere cuatro fines de semana y la coordinación de varios especialistas en los distintos recursos naturales. Como proyectos, se completaron los inventarios en parcelas de caoba plantada y en los bosques naturales. El "Team" es una fuente de varios candidatos para carreras en silvicultura y otros trabajos aliados.

INSTITUTO DE DASONOMIA TROPICAL

Fundado en el 1939. Dependencia del Servicio Forestal del Departamento de Agricultura de los Estados Unidos de América. Estación Forestal Experimental del Sur, New Orleans, Louisiana. Dirección postal: USDA Forest Service, Institute of Tropical Forestry, Call Box 25000, Río Piedras, P.R. 00928-2500. Dirección domiciliaria: Estación Experimental Agrícola, Universidad de Puerto Rico, Río Piedras, P.R. Teléfono: 809-766-5335, FTS- 489-5335, FAX- 809-250-6924.

HISTORIAL: Originalmente denominado Estación Experimental Tropical bajo la autoridad de la ley de Investigación Forestal McSweeney-McNeary del 1928. El nombre cambió a Instituto de Dasonomía Tropical en 1961. Inicialmente la unidad funcionaba bajo la jurisdicción de la oficina central en Washington, D.C., fue transferido a la Estación Forestal Experimental del Sur en 1978. Tambien reconocido como Unidad de Trabajo de Investigación SO-1152 (1978-1985) y desde entonces como SO-4151.

DIRECTORES: Arthur Bevan (1939-1943), Arthur T. Upson (1943-1951), Henry B. Bosworth (1949-1953), I.P. Murray (Administrador, 1953-1955), Frank H. Wadsworth (Líder de Centro de Investigaciones 1949-1956, Director 1956-1978), Ariel E. Lugo (Líder de Proyecto 1978-presente, Director 1988-presente).

CIENTIFICOS (presentes en itálicas): C.B. Briscoe, R.S. Boone, M. Chudnoff, T.R. Crow, G.H. Englerth, *J.K. Francis,* T.F. Geary, L.H. Holdridge, J. Kalina, A. Krochmal, F.B. Lamb, L.H. Liegel, *A.E. Lugo*, F.R. Longwood, J. Marrero, *F.N. Scatena*, T.H. Schubert, *J. Torres*, C.R. Venator, *F.H. Wadsworth*, *P.L. Weaver*, *J. Wunderle*, J.L. Whitmore.

CIENTIFICOS VISITANTES CON ESTADIAS EN EXCESO DE UN AÑO: S. Brown, J.L. Frangi, A. Gillespie, E. Medina, E. Cuevas, J.F. McCormick, H.T. Odum.

PROGRAMA CIENTIFICO: El Instituto tiene programas en cinco áreas: (1) manejo de plantaciones, (2) manejo de bosques secundarios, (3) manejo de vida silvestre en peligro de extinción, (4) manejo de cuencas hidrográficas, y (5) transferencia de información para aquellos con interés en la dasonomía tropical. En adición, el Instituto lleva a cabo numerosos estudios en colaboración con Instituciones de investigación, educación y manejo de recursos naturales. Entre los ejemplos de programas de investigación cooperativos se incluyen: Programa del Bióxido de Carbono del Departamento de Energía de los Estados Unidos, Programa de Investigaciones Ecológicas a Largo Plazo de la Fundación Nacional de Ciencias de los Estados Unidos, Programa de Biología y Fertilidad de Suelos de la Unión Internacional de Sociedades de Ciencias Biológicas, Estudios de Plantaciones de Pino en el Caribe y Centro América con el apoyo de la Agencia Internacional para el Desarrollo de los Estados Unidos.

COLABORADORES INSTITUCIONALES:

Gobiernos

Ministerio de Agricultura, Jamaica; Ministerio de Agricultura, Tierras y Pesquerías, Santa Lucía; Ministerio de Agricultura, Tierras y Pesquerías, Dominica, Ministerio de comercio y Agricultura, San Vicente y las Granadinas, Ministerio de Agricultura, Barbados; Ministerio de Agricultura, Antigua; Ministerio de Agricultura, Tierras y Producción de Alimento, Trinidad y Tobago.

Organizaciones Internacionales

Instituto de Manejo de la Región del Caribe, Organización para la Alimentación y la Agricultura, Programa del Hombre y la Biosfera de la UNESCO, Unión Internacional de Organizaciones de Investigación Forestal.

Agencias del Gobierno de los Estados Unidos de América

Bosque Nacional del Caribe, Cuerpos de Paz, Oficina de Evaluación Tecnológica, Programa del Hombre y la Biosfera del Departamento de Estado, Servicio de Pesca y Vida Silvestre, Servicio Geologico, Servicio Nacional de Parques.

Agencias del Gobierno de Puerto Rico

Departamento de Recursos Naturales; Universidad de Puerto Rico incluyendo múltiples dependencias como el Centro de Estudios Energéticos y Ambientales, Centro de Recursos para la Ciencia y la Ingeniería, Estación Experimental Agrícola, Departamentos de Biología en varios recintos del sistema, Jardín Botánico y otros.

Agencias de Estados de Estados Unidos de América

Servicio de Investigación Agrícola de Carolina del Norte.

Agencias de Gobiernos Exteriores

Instituto Venezolano de Investigaciones Científicas.

Universidades

Alacala de Henares, Madrid; Colorado, Boulder; Florida, Gainesville; Georgia, Athens; Michigan State, East Lansing; Missouri, Colombia; New York, Syracuse; Pennsilvania, Philadelphia; Puerto Rico, Rio Piedras; Tennessee, Knoxville; Wageningen, Netherlands (Holanda); Wisconsin, Madison; Yale, New Haven.

Instituciones Privadas

Fideicomiso Nacional de Montserrat; Fundación de Investigación Isleña; Instituto de Estudios de Ecosistemas; Niños Escuchas de América; Sociedad Internacional de Dasónomos Tropicales.

PREMIOS Y RECONOCIMIENTOS:

Servicio Superior del Departamento de Agricultura de los Estados Unidos (1964,1985,1989);

Designación del Bosque Experimental de Luquillo como una Reserva Biosférica del Programa del Hombre y la Biosfera de UNESCO (1976);

Premio por Servicio Meritorio del Departamento de Agricultura de los Estados Unidos (1979);

Premio Especial de Mérito de la Agencia de Protección Ambiental de los Estados Unidos (1980);

Técnico del Año de la Estación Experimental del Sur (1988);

Unidad con el mejor programa de derechos civiles en la Estación Experimental del Sur (1988);

Premio por Servicio Distinguido del Departamento de Agricultura de los Estados Unidos (1988);

Premio "Global 500" del Programa Ambiental de la UNESCO (1989);

RESUMEN DE LOGROS:

Se han desarrollado las bases técnicas para el manejo de la tierra en Puerto Rico, utilizando criterios con aplicabilidad regional.

Se han determinado las mejores especies para la reforestación de tierras degradadas en Puerto Rico, las Islas Vírgenes y la región del Caribe

Se han perfeccionado las prácticas asociadas con semillas, viveros, plántulas, y siembra de las especies más idóneas para la reforestación de la región.

Se han publicado descripciones ilustradas de la flora arbórea de Puerto Rico y las Islas Vírgenes (alrededor de 750 especies, muchas de valor regional).

Se han determinado las características físicas y susceptibilidad a uso de maquinaria en más de 100 especies madereras de Puerto Rico y el Caribe.

Se han determinado la vida útil de postes no tratados de 40 especies típicas de la región. Se aumento la vida útil por un factor de 10 con tratamientos en preservativos calientes y fríos.

Se ha determinado la tasa de crecimiento de más de 100 especies arbóreas nativas de las seis zonas de vida de Puerto Rico, y comunes a la región del Caribe. Los estudios cubren condiciones de secas a muy hümedas, árboles de distintos tamaños y en distintas posiciones en el dosel, y sirven para tratamientos silviculturales y al fin de aumentar los rendimientos.

Se inauguró y se vienen sosteniendo por más de 20 años las investigaciones para recuperar la cotorra Puertorriqueña de su inminente extinción. Los estudios son aplicables a otras especies en la región.

Se adaptó la tecnología de secadores solares para el secado rápido de madera bajo condiciones tropicales.

Se desarrolló un mecanismo para hacer incisiones en la madera y facilitar la penetración de preservativos en maderas poco permeables útiles para postes.

Participamos en 13 de las 14 sesiones de la Comision Forestal Latinoamericana de la FAO y se ha presidido el comité de investigaciones científicas por 16 años.

Se editó una revista dasonómica bilingüe y regional, *The Caribbean Forester*, por 24 años y el boletín informativo de la Sociedad Internacional de Dasónomos Tropicales. Este boletín lleva 10 años de publicación y se distribuye globalmente.

Se han publicado más de 500 trabajos científicos de importancia local, regional y global.

Se han realizado consultorías para resolver problemas forestales en los siguientes paises: Mexico, Costa Rica, Islas Vírgenes Británicas, St. Kitts, Antigua, Montserrat, Dominica, República Dominicana, Haití, Jamaica, St. Lucia, St. Vincent, Grenada, Trinidad y Tobago, Venezuela, Colombia, Ecuador, Perú, Brasil, Paraguay, Argentina y Malasia.

Se han publicado monografías comparando el crecimiento de plantaciones a través de todas las zonas de vida de la región.

Se han definido y publicado mapas de la zonas de vida de Puerto Rico y Brasil.

Se ha estudiado en detalle la estructura y dinámica de los bosques subtropicales secos, húmedos y muy húmedos en Puerto Rico, los cuales son representativos de muchos otros en el Caribe.

Se ha analizado la producción y almacenaje de biomasa en bosques tropicales del mundo en relación al problema del balance de carbono del planeta.

Se han completado tres inventarios de los bosques de Puerto Rico, uno de los bosques de St. Vincent, habiéndose además estudiado la vegetación de St. Johns, Islas Vírgenes Americanas. Las técnicas son aplicables a la región.

Se ha analizado el daño de huracanes (David, Gilberto, Hugo) en los bosques y vida silvestre de Dominica, Jamaica, Montserrat y Puerto Rico.

Se ha dirigido desde 1980 el programa tropical del Programa del Hombre y la Biosfera de los Estados Unidos.

Se ha estudiado por más de 12 años las aves migratorias que visitan al bosque de Guánica en la zona de vida seca de Puerto Rico.

Se completaron estudios comparativos del crecimiento de *Pinus caribaea* en Puerto Rico, Trinidad y Tobago, Venezuela, Jamaica, y Costa Rica.

Se publicó una bibliografía completa (cubre más de 100 años) de los trabajos dasonómicos en Puerto Rico.

Se han publicado análisis comparativos de la vida silvestre de las Antillas.

Se han publicados estudios sobre plantaciones de caoba (*Swietenia*) con aplicabilidad a toda la región.

Se mantiene un arboretum con más de 60 especies arbóreas (nativas y exóticas) de valor como productoras de madera.

Se mantiene un banco de variedades y especies de caoba, representativas de la región.

Se desarrolló un herbario con más de 400 especies de árboles nativos de Puerto Rico y la región del Caribe.

Se desarrollaron técnicas para el cultivo de caoba en lugares secos de Santa Cruz, en regiones representativas a otros lugares secos de la región.

PUBLICACIONES (Página 45)

Publications requests should be addressed to:

Pedidos de cualquiera de las publicaciones disponibles deben ser dirigidos a:

Southern Forest Experiment Station
USDA Forest Service
Institute of Tropical Forestry
Call Box 25000
Río Piedras, Puerto Rico 00928-2500

Our regulations require that our mailing list be updated annually. **If any correction of your address is necessary, please indicate both your current and previous address as our addresses are filled by geographical location.**

***

Nuestros reglamentos requieren que la lista de distribución sea revisada anualmente. **De ser necesario corregir su dirección, favor de indicarnos tanto su dirección actual como la anterior debido a que nuestras direcciones son archivadas por localización geográfica.**

Current address	Previous address
_____	_____
_____	_____
_____	_____
_____	_____